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SOCIAL COGNITIVE PREDICTORS OF COLLEGE STUDENTS'  
FRUIT AND VEGETABLE INTAKE

by

Denice C. Ahlstrom

A thesis submitted in partial fulfillment  
of the requirements for the degree

of

MASTER OF SCIENCE

in

Health, Physical Education and Recreation

Approved:

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Matthew Flint, PhD  
Major Professor

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Dean of Graduate Studies

UTAH STATE UNIVERSITY  
Logan, Utah

2009

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## ABSTRACT

Social Cognitive Factors Related to College Students'

Fruit and Vegetable Intake

by

Denice C. Ahlstrom, Master of Science

Utah State University, 2009

Major Professor: Matthew Flint, PhD

Department: Health, Physical Education, and Recreation

This study examined the social cognitive theory factors of home availability of fruits and vegetables, nutrition knowledge, food preparation ability, and cooking self-efficacy and the demographic factors of race/ethnicity, age, gender, marital status, living situation, and meal plan participation in relation to college students' fruit and vegetable consumption. The study sample was comprised of students attending on-campus classes at Utah State University during spring semester of 2009. Data were collected via traditional pencil-and-paper surveys distributed during classes with students in varying stages of their college education and from different fields of study. In total, 207 surveys were used for the linear regression analysis.

Race/ethnicity was not included in the regression model due to lack of sufficient racial/ethnic diversity. Of the remaining variables, availability of fruits and vegetables in the home, cooking self-efficacy, and meal plan participation were found to be significant predictors of college students' fruit and vegetable consumption. Availability in the home was the strongest predictor of fruit and vegetable intake in this sample.

(122 pages)

## ACKNOWLEDGMENTS

Many thanks to my committee members, Drs. Matthew Flint, Julie Gast, and Tamara Vitale, for their support and help throughout this entire process. Thanks to my peers and friends in the program who have been willing to listen to my ideas and give me encouragement when I needed it. Special thanks to my parents, who had to read the transcript multiple times. Most importantly, thank you Doug. You stood by me when I was running at full speed, and pushed me forward when I wanted to quit. This would not have been possible without your love, support, encouragement, and patience.

Denice C. Ahlstrom

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## CHAPTER 1

### INTRODUCTION

Eating a diet high in fruits and vegetables has been shown to reduce the risk of many chronic diseases, including stroke, cardiovascular disease, diabetes, and certain types of cancer, and can promote overall health (U.S. Department of Health and Human Services [USDHHS], 2005a). The American Cancer Society, American Heart Association, and other prominent health agencies have acknowledged the relationship between a diet high in fruits and vegetables and good health and have consequently put forth recommendations encouraging Americans to consume an adequate amount of fruits and vegetables. Each of these agencies recommends that all adults consume a minimum of two servings of fruit and three servings of vegetables per day (American Cancer Society Nutrition and Physical Activity Guidelines Advisory Committee [ACS], 2006; American Heart Association [AHA], 2007; USDHHS). There is evidence that most Americans do not consume even the minimum recommended levels of fruits and vegetables on a regular basis (Guenther, Dodd, Reedy, & Krebs-Smith, 2006). Guenther et al. demonstrated that less than half (40%) of the American population meets the minimum recommendation for fruit and vegetable intake.

There is substantial evidence that adolescents and college students are even less likely to consume the recommended levels of fruits and vegetables (DeBate, Topping, & Sargent, 2001; Dinger, 1999; Haberman & Luffey, 1998; Li Hui et al., 2008). Of the studies examining college students' fruit and vegetable intake, all but one (Kasperek, Corwin, Valois, Sargent, & Morris, 2008) found that less than half of college students consume the minimum recommended level of fruits and vegetables on a regular basis. This indicates that there is room for substantial improvement in college students' intake of fruits and vegetables.

Many health behavior theories have been used to understand and explain why individuals do not consume the recommended servings of fruits and vegetables. Social cognitive

theory (SCT) is one theory that has been used in many successful interventions aimed at increasing fruit and vegetable intake (Baranowski et al., 2000; Granner, 2004; Neumark-Sztainer, Wall, Perry, & Story, 2003). According to SCT, many factors influence health behavior (Bandura, 1986). The theory is based on the underlying premise of reciprocal determinism, which is the notion that environmental and personal factors interact dynamically with behavior (Bandura, 1999). Thus, a change in one of these factors should affect the others. The SCT factors that were examined in this study were home availability of fruits and vegetables, nutrition knowledge, food preparation ability, and cooking self-efficacy. These factors are discussed below.

One environmental factor that influences fruit and vegetable intake is the availability of fruits and vegetables in the home. Although only one study has examined this association in college students (Harris & Murray, 1997), several studies (Bere & Klepp, 2005; Cullen et al., 2003; Hearn et al., 1998) have confirmed that having fruits and vegetables available in the home has a positive, significant influence on the amount of fruits and vegetables that children eat. Additionally, a few studies have illustrated the same relationship between home availability and fruit and vegetable intake in young adolescents (Granner et al., 2004; Neumark-Sztainer et al., 2003; Young, Fors, & Hayes, 2004). Further research is needed to determine whether the association between home availability and consumption of fruits and vegetables holds true in a college student population.

In addition to the environmental factor of home availability, personal factors influence fruit and vegetable intake. According to SCT, the construct of behavioral capability maintains that a person must have both the skills and knowledge necessary to perform a particular behavior. Knowledge of basic nutrition principles and skills in food preparation may be needed to achieve the recommended levels of fruit and vegetable consumption (Caraher & Lang, 1999; Michaud, Condrasky, & Griffin, 2007). Michaud et al. suggested that having a greater knowledge of basic

nutrition principles may enable a person to make healthier food choices. But even with adequate nutrition knowledge, lack of food preparation skills may act as a barrier to implementing recommendations of how to prepare foods in a healthier way (e.g. cooking with less added fat) (Caraher & Lang, 1999; Stead, Caraher, & Anderson, 2004). Caraher and Lang also suggested that a lack of food preparation skills may lead to a reliance on ready-prepared foods (such as frozen dinners or canned meals), which often have little, if any, fruits or vegetables.

The research regarding nutrition knowledge and its impact on fruit and vegetable intake has yielded conflicting results. This may be due to inconsistent perceptions of what nutrition knowledge constitutes and a lack of validated instruments to measure nutrition knowledge (Worsley, 2002). However, some studies have shown that nutrition knowledge can significantly and positively impact fruit and vegetable intake (Ming-Chin et al., 2008; Wardle, Parmenter, & Waller, 2000; Wei, Hsiao-Chi, Chi-Ming, & Wen-Harn, 2007) , or that it may have a mediating effect on other variables related to fruit and vegetable intake (Beydoun & Wang, 2008; Reynolds, Yaroch, Franklin, & Maloy, 2002). Although some studies have found no association between nutrition knowledge and fruit and vegetable intake (Gibson, Wardle, & Watts, 1998; Steptoe, Perkins-Porras, Rink, Hilton, & Cappuccio, 2004), no studies have shown that nutrition knowledge has a negative impact on fruit and vegetable intake. Moreover, no studies have examined the relationship between nutrition knowledge and fruit and vegetable intake in college students.

According to the SCT construct of behavioral capability, knowledge alone may not be sufficient to change a behavior; a person also needs the skills associated with the behavior in order to successfully perform the behavior. Several studies have shown that food preparation skills can positively impact fruit and vegetable intake in elderly men (Holmes, Roberts, & Nelson, 2008; Hughes, Bennett, & Hetherington, 2004), families (Wrieden & Symon, 2003), and low-income women (McLaughlin, Tarasuk, & Kreiger, 2003). In adolescents, it has been found

that time spent in food preparation (Larson, Perry, Story, & Neumark-Sztainer, 2006) and food preparation skills (Larson, Story, Eisenberg, & Neumark-Sztainer, 2006) may increase fruit and vegetable consumption. However, no studies have specifically examined college students' nutrition knowledge and food preparation skills in relation to their fruit and vegetable consumption.

Another personal factor that could increase fruit and vegetable intake, according to SCT, is self-efficacy. Self-efficacy is a person's belief in their ability to perform a certain behavior through controlling both their own performance and other events that affect that behavior (Bandura, 1991). For the purpose of this study, self efficacy will be conceptualized as cooking self-efficacy. Cooking self-efficacy is not well-understood in the research literature. One study (Lawrence, Thompson, & Margetts, 2000) found that women with greater confidence in their cooking ability were more likely to consume the recommended levels of fruits and vegetables. The only study conducted with adolescents found no correlation between cooking self-efficacy and fruit and vegetable intake (Larson, Perry, et al., 2006). However, several other studies indicate that self-efficacy related to healthy eating can have a significant impact on fruit and vegetable consumption (Hagler et al., 2007; Van Duyn et al., 2001; Watters, Satia, & Galanko, 2007).

### Problem Statement

In general, less than half of Americans consume the minimum amount of fruits and vegetables recommended by leading health agencies (Guenther et al., 2006), and college students' intake of fruits and vegetables is even worse (DeBate et al., 2001; Dinger, 1999; Haberman & Luffey, 1998). Reciprocal determinism asserts that environmental and personal factors can dynamically interact with behaviors, such as fruit and vegetable consumption. There is some evidence that availability of fruits and vegetables in the home (an environmental factor) (Bere &

Klepp, 2005; Cullen et al., 2003; Granner, 2004), nutrition knowledge and food preparation skill (components of behavioral capability) (Gibson et al., 1998; Hughes et al., 2004; Larson, Perry, et al., 2006; Larson, Story, et al., 2006; Wardle et al., 2000) and self-efficacy (a personal factor) (Hagler et al., 2007; Van Duyn et al., 2001; Watters et al., 2007) may increase fruit and vegetable intake.

No studies have examined these factors as predictors of college students' fruit and vegetable consumption. Therefore, the purpose of this study was to determine whether availability of fruits and vegetables in the home, nutrition knowledge, food preparation skills, and cooking self-efficacy were predictive of college students' fruit and vegetable intake.

### *Research Questions*

1. Is availability of fruits and vegetables in the home predictive of college students' fruit and vegetable intake?
2. Is nutrition knowledge predictive of college students' fruit and vegetable intake?
3. Is food preparation ability predictive of college students' fruit and vegetable intake?
4. Is cooking self-efficacy predictive of college students' fruit and vegetable intake?
5. Are the demographic factors of race/ethnicity, age, gender, marital status, living situation, or participation in a campus meal plan predictive of college students' fruit and vegetable intake?

### *Significance of the Study*

The factors studied that are shown to be predictive of college students' fruit and vegetable intake can be used in planning, implementing, and evaluating programs designed to help college students eat more fruits and vegetables. Increased fruit and vegetable intake has been shown to reduce the risk of many chronic diseases, including stroke and cardiovascular disease,

diabetes, and cancer and promotes overall health (USDHHS, 2005a) and can promote overall health and wellbeing.

#### *Assumptions*

1. The statistical analysis used in this study relies on predictive statistical analysis of variables and, therefore, does not allow for the inference of causality.
2. Participants will respond accurately and honestly to the survey questions, and will be able to accurately recall their behavior to provide such responses.
3. Instruments used to collect data are valid and reliable.

#### *Delimitations*

1. College students at Utah State University may not be representative of college students throughout the nation.
2. The sample will be obtained through convenience, and no attempts at randomization will be made.

#### *Limitations*

1. As the study utilizes self-report instruments, behavior may not be accurately measured.
4. Participants may not be completely honest in their answers or may exhibit recall bias.

#### Definition of Terms

Availability of fruits and vegetables: Presence of juice, fruits, or vegetables in the home during the past 7 days, whether fresh, frozen, canned or dried (Marsh, Cullen, & Baranowski, 2003).

Cooking self-efficacy: Confidence in one's ability to perform the actions needed to prepare foods.

Food preparation ability: The practical knowledge and ability needed to prepare familiar dishes prior to their consumption (Anderson, Bell, Adamson, & Moynihan, 2002).

Fruit and vegetable intake: Daily average of total servings of fruits and servings of vegetables consumed.

Fruit serving:  $\frac{1}{2}$  cup fresh, frozen, or canned fruit; 1 medium fruit;  $\frac{1}{4}$  cup dried fruit; or  $\frac{1}{2}$  cup fruit juice (USDHHS, 2005a).

Nutrition knowledge: Knowledge of current dietary recommendations and nutrients provided by foods and understanding of diet-disease relationships (Parmenter & Wardle, 1999).

Vegetable serving:  $\frac{1}{2}$  cup raw or cooked vegetables; 1 cup leafy vegetables; or  $\frac{1}{2}$  cup vegetable juice (USDHHS, 2005a).

## CHAPTER 2

### REVIEW OF THE LITERATURE

This chapter provides a review of social cognitive theory and the literature relating SCT to fruit and vegetable intake. The specific constructs addressed include home availability of fruit and vegetables, nutrition knowledge, food preparation skills, and cooking self-efficacy. Differences in intake related to demographic characteristics are also discussed. This chapter also provides an overview of the current recommendations in regards to fruit and vegetable intake and their relationship to disease risk and overall health.

#### Fruit and Vegetable Recommendations

Eating a diet high in fruits and vegetables has been shown to reduce the risk of many chronic diseases, including stroke, cardiovascular disease, diabetes, and some types of cancer, and promotes overall health (USDHHS, 2005a). Many well-recognized health agencies have acknowledged the relationship between a diet high in fruits and vegetables and good health and have consequently put forth recommendations encouraging Americans to consume more fruits and vegetables (ACS, 2006; AHA, 2007; USDHHS).

The document Healthy People 2010 (USDHHS, 2005b) outlines important health goals for the nation. According to Healthy People 2010, two of the objectives for the nation are first, increase the proportion of persons aged 2 years and older who consume at least two daily servings of fruit, and second, increase the proportion of persons aged 2 years and older who consume at least three daily servings of vegetables (USDHHS). Combining these objectives equates to a minimum recommendation of five servings of fruits and vegetables combined daily for all people over the age of 2 years.



The American Cancer Society (ACS) and American Heart Association (AHA) have also made recommendations for fruit and vegetable intake. The ACS (2006) recommends that adults eat five or more servings of a variety of vegetables and fruits every day. The AHA (2007) recommends at least four to five servings of fruits and four to five servings of vegetables every day for all adults. In addition, the document *Dietary Guidelines for Americans* indicate that adults should consume at least two servings of fruit and three servings of vegetables every day and should aim for an even higher intake in order to assure maximum health benefits (USDHHS, 2005a). Each of these prominent health organizations have based their recommendations on past and current research indicating that a diet high in fruits and vegetables promotes optimal health and wellbeing. Each of the recommendations has a similar message, that adults should consume at least five servings of fruits and vegetables every day. Furthermore, most of the recommendations suggest that an even higher intake of fruits and vegetables would further enhance the derived health benefits.

#### College Students' Fruit and Vegetable Intake

Using data from the 1999-2000 NHANES and 1994-1996 SCFII national health surveys to determine the average fruit and vegetable consumption of Americans, Guenther et al. (2006) found that only 40% of the US population consumes at least five servings of fruits and vegetables on a daily basis. Separating results based on age and gender, the researchers found that young adult males may consume about the same amount of fruits and vegetables as the average American: 37% of boys ages 11-18 years and 44.7% of men ages 19-30 consume at least five servings of fruits and vegetables a day. In women, only 29.7% of girls ages 11-18 and 14.1% of women ages 19-30 years eat at least five servings of fruits and vegetables per day.

There is considerable evidence that very few American college students regularly consume at least five servings of fruits and vegetables on a daily basis (DeBate et al., 2001;

Dinger, 1999; Haberman & Luffey, 1998; Lowry et al., 2000). One national sample revealed that college students consume even fewer fruits and vegetables than average Americans (Lowry et al.). Using data from the 1995 National College Health Risk Behavior Survey, the researchers looked at exercise, fruit and vegetable intake, weight management practices, height and weight, and body satisfaction. The sample of participants was selected using a two-stage cluster sample design in order to obtain a sample that represented US undergraduate students ages eighteen and older. Participants were classified as consuming at least five servings of fruits and vegetables or consuming less than five servings. Overall, only 26.3% of the students reported consuming at least five servings of fruits and vegetables daily. Males appeared to consume more fruits and vegetables. Of the males, 28.1% reported eating at least five servings per day, while only 25% of females reported eating at least five servings of fruits and vegetables per day.

University students' fruit and vegetable intakes are very low, according to data from a different national sample (DeBate et al., 2001). Student participants ( $N = 630$ ) were asked to report on their diet practices, weight control behaviors, and demographic and anthropometric information. Based on Food Guide Pyramid recommendations (two servings of fruit and three servings of vegetables), the participants were categorized as meeting or not meeting the recommendations. While 31.2% of the students met the recommended intake for fruits, only 1.3% of participants reported meeting the recommended intake for vegetables! The average intakes were 1.1 servings of fruit and 1.6 servings of vegetables per day.

Fruit and vegetable consumption varied according to demographic characteristics. Males were less likely than females to eat the recommended amount of vegetables, but both groups fell substantially short of meeting the recommendation for fruits or vegetables. Only 1% of males and 1.4% of females ate at least three servings of vegetables per day, while 31.4% of males and 30.8% of females ate at the minimum recommended level of two fruit servings per day. Both male and female African American students were less likely than their white peers to eat the

recommended amount of fruits or vegetables. While 1.3% of white males ate at least three servings of vegetables per day, zero percent of the African American males met the minimum recommendation. In females, 0.8% of African American students ate three servings of fruits and vegetables while 1.6% of white female students met the same objective. Fruit intake followed a similar pattern; white males and females were more likely to meet the minimum recommended intakes (32% versus 29.3% of males and 32.5% versus 26.1% of females) than African American males or females.

In addition to the large national studies, many studies at colleges and universities across the nation have found that college students, in general, are not consuming the recommended levels of fruits and vegetables. Freshman university students in South Carolina participated in an internet-based survey (Kasperek et al., 2008) focused on health behaviors. Participants reported on demographic information, height and weight, physical activity, alcohol intake and diet patterns. Measurements were taken during the first few weeks of fall semester (baseline data) and again in spring semester (follow-up); 193 students participated in the survey. Fruit and vegetable intake was categorized as either adequate (at least 11 servings per week, combined) or low (less than 11 servings per week, combined). At baseline, 87.9% of the participants had “adequate” intakes of fruits and vegetables. However, at follow-up, only 79.9% of the participants still had “adequate” intake. Chi-squared tests indicated that this change was significant, indicating a noteworthy decrease in fruit and vegetable consumption over the course of the school year.

Students at the University of Pittsburgh in Pennsylvania were asked to complete the Survey of Selected Health Practices of College Students (Haberman & Luffey, 1998). The survey assessed exercise and diet habits as well as self-reported height and weight. A total of 302 students completed the survey. Of those participants, 81.7% reported that they did not eat at least five servings of fruits and vegetables per day.

Female students in Houston, Texas also were lacking fruits and vegetables in their diets (Anding, Suminski, & Boss, 2001). The women ( $N = 60$ ) were students enrolled in aerobic exercise classes. They were asked to complete a questionnaire assessing socioeconomic status, exercise and diet habits, and anthropometric data. Only nine (15%) of the participants reported eating five or more servings of fruits and vegetables daily.

In Illinois, students living in residence halls and fraternity or sorority homes were asked to fill out a survey measuring gender, residential status, fraternity/sorority membership, source of nutrition and exercise information, physical activity and dietary practices (Dinger, 1999). All of the participants lived in on-campus residence halls or in fraternity or sorority houses. All of the participants ( $N = 743$ ) were 18 years or older. The average combined fruit, juice, and vegetable intake of the students was 2.9 servings per day. The researcher found no significant differences in intake based on gender or on living situation.

At a university in the southern region of the US, Mexican-American students completed a self-administered questionnaire to gauge psychosocial variables, fruit and vegetable intake, and attitudes, beliefs and knowledge about health and nutrition (Evans, Sawyer-Morse, & Betsinger, 2000). Students ( $N = 107$ ) ages 20-24 years participated in the study. The average combined fruit and vegetable intake for this group was only 2.2 servings per day. Additionally, 59% of the sample ate less than 2.5 servings of fruits and vegetables per day; a mere 7.4 % consumed at least the recommended five or more servings of fruits and vegetables per day.

A study at the University of Kansas utilized a convenience sample to examine college students' eating habits (Huang et al., 2003). Participants ( $N = 736$ ) were students ages 18 to 27 years. The researchers used the validated Berkeley Fruit, Vegetable, and Fiber Screener as the tool to assess fruit and vegetable intake in the students. The average combined fruit and vegetable intake for the sample was 4.2 servings per day. Of the participants, 69.4% consumed less than five servings of fruits and vegetables per day.

First-year college students enrolled in a university meal plan in Virginia were asked to participate in an online cross-sectional survey (Kolodinsky, Harvey-Berino, Berlin, Johnson, & Reynolds, 2007). The survey was designed to measure dietary intake, nutrition knowledge, demographic information, and self-reported height and weight. One hundred ninety-three students, ages 18-20 years, participated in the survey. Participants' fruit and vegetable intakes were compared to the Food Guide Pyramid recommendations, which vary based on height, weight, and physical activity level. The researchers found that 37.5% of the students ate at least as much fruit as was recommended for their height, weight, and activity status and 38.3% ate at least as many vegetables as was recommended.

Researchers in Missouri also found that college students were lacking in fruit and vegetable intake (Racette, Deusinger, Strube, Highstein, & Deusinger, 2008). A convenience sample of undergraduate students at a university in Missouri was asked to complete assessments during the first two weeks of their freshman year and again during the last two weeks of their senior year. Assessments included height, weight, demographics, exercise and diet habits; 204 students completed both assessments. At baseline, only 29% of freshman ate at least five servings of fruits and vegetables daily. When assessed again as seniors, 71% still did not consume at least five servings of fruits and vegetables per day. There was no difference in the percentage of students consuming at least five servings of fruits and vegetables between the two assessments. The researchers did not assess whether there were differences between groups based on demographic characteristics.

A study comparing U.S. students to international students found that while U.S. students may eat more fruits and vegetables than their international counterparts, they still do not meet the current recommendations for fruit and vegetable consumption. Students in California ( $n = 137$ ) and Taiwan ( $n = 93$ ) participated in a study that compared the two groups' eating patterns (Li Hui et al., 2008). Participants were asked to keep a 3-day food record that covered two weekdays and

one weekend day. The records were used to determine usual intake of four general food groups: fruits and vegetables, milk, grains, and meats/beans. In California, the average fruit and vegetable intake was 3.8 servings per day, while in Taiwan, the average intake was 2.6 servings per day.

The studies discussed in this section indicate that, overall, college students in America are not meeting the minimum fruit and vegetable consumption recommendations of prominent health agencies. All of the studies demonstrated that less than half of American college students are eating at least five servings of fruits and vegetables daily. These findings indicate that there is room for substantial improvement in college students' fruit and vegetable intake.

### Social Cognitive Theory

One behavioral theory that has been used successfully in programs aimed at increasing fruit and vegetable consumption in children (Baranowski et al., 2000; Granner, 2004) is SCT. Some studies have used SCT to examine and explain fruit and vegetable intake in adolescents (Larson, Perry, et al., 2006; Neumark-Sztainer et al., 2003), and have shown that SCT may be an appropriate framework for understanding college students' fruit and vegetable consumption.

#### *History of SCT*

Albert Bandura is the person most commonly associated with SCT because he was the major participant in the development of the theory (see, for example, Bandura, 1977, 1986). SCT started to develop in 1962 (Bandura, 1962; Bandura & Walters, 1963) when Bandura published articles based on social learning and operant learning theories, but later added the concepts of observational learning and vicarious reinforcement. In 1977, he added the concept of self-efficacy to the developing theory (Bandura, 1977), and in 1978 organized the theory according to the idea of reciprocal determinism (Bandura, 1978). Although SCT, then known as social learning theory, was tested in some early studies (Farquhar et al., 1977; Parcel & Baranowski, 1981), it was not

until Bandura published a book (Bandura, 1986) that conceptualized the framework of SCT and included all of the constructs that are commonly associated with SCT today that SCT became well known.

Since then, SCT has been used widely in the field of health in the development of programs, interventions and research (Baranowski et al., 2000; Granner, 2004). Many studies seek to determine whether SCT constructs do, in fact, influence behavior (Bere & Klepp, 2005; Larson, Perry, et al., 2006; Neumark-Sztainer et al., 2003). Several studies have used SCT constructs to examine the factors related to fruit and vegetable intake.

### *Components of SCT*

Social cognitive theory is a very broad theory encompassing many constructs that influence behavior. The major constructs of SCT that are commonly used in health settings are described below.

Reciprocal determinism: The underlying premise of SCT is the concept of reciprocal determinism, which is the notion that environmental and personal factors interact dynamically with behavior (Bandura, 2001). Thus a change in environment, personal factors, or behavior would impact the other factors (Bandura, 1986). Bandura (1986) emphasized that behavior is not just a product of environmental and personal factors but that all three are constantly shaping each other.

Environmental factors: Aspects that influence a person's behavior, but that are not physically part of the person are considered environmental factors (Bandura, 1986). Social influences are considered one type of environmental factor. Environmental factors can be as diverse as room temperature or city policies, and influence behavior in a variety of ways.

Behavioral capability: The concept of behavioral capability holds that in order for a person to perform a particular behavior, the person must have both the skills and knowledge related to that behavior (Bandura, 1986).

Self-efficacy: Self-efficacy is a person's belief in their ability to perform a certain behavior through controlling their own level of functioning and controlling other events that affect that behavior (Bandura, 1991). According to Bandura (1986, 1991), self-efficacy may arguably be one of the most important aspects of behavior change because a person's belief in their ability influences choices, effort expended, and how long the person perseveres in the behavior. Self-efficacy may also influence behavior because people are more interested in and place more value in activities in which they feel efficacious (Bandura, 1991).

Self-regulation/management: Self regulation refers to one's ability to intentionally influence their own functioning and behavior in order to achieve a goal (Bandura, 1986, 2001). Self-regulation involves consciously assessing and deliberately processing information in order to evaluate possible courses of action. It also involves the ability to recognize and effectively cope with emotional arousal that may otherwise hamper the ability to participate in a given behavior (Bandura, 1977).

Reinforcement: Reinforcements are responses to behavior that influence the likelihood of whether the behavior will be repeated (Bandura, 1986). Three types of reinforcement are commonly associated with SCT: direct reinforcement, vicarious reinforcement, and self-reinforcement.

Outcome expectations and expectancies: A person's outcome expectations are what they believe will happen in response to a certain behavior or situation. Outcome expectancies are the values that the person places on the expected outcome (Bandura, 1986). Outcome expectations and expectancies may work together to impact behavior; absence of one would practically negate the effect of the other component.



Learning through observation: SCT posits that a person can learn a behavior by observing another person performing the behavior and the reinforcements they involve.

Observational learning can be an efficient method of behavior change, as it allows the person to learn the behavior vicariously without lengthy experimentation with a variety of behaviors.

The following sections will review those studies that have examined the SCT constructs of availability of fruits and vegetables (an environmental factor), nutrition knowledge (a component of behavioral capability), food preparation skills (a component of behavioral capability), and cooking self-efficacy in relation to fruit and vegetable intake.

#### Environment: Access to Fruits and Vegetables in the Home

One environmental factor that could influence fruit and vegetable intake is the availability of fruits and vegetables in the home. Many studies have sought to determine the relationship between home availability and intake of fruits and vegetables. The following studies represent the current literature in this area.

The authors of a literature review assessing fruit and vegetable availability related to fruit and vegetable intake concluded that home availability is associated with fruit and vegetable consumption for children, adolescents, and adults (Jago, Baranowski, & Baranowski, 2006). The review included articles from 1993 to 2005 and represented a variety of qualitative, cross-sectional, and experimental studies related to fruit and vegetable intake. Of the qualitative studies reviewed, all indicated that increased fruit and vegetable availability positively influenced intake or that a lack of availability hindered fruit and vegetable intake. All but two of the cross-sectional studies found that availability and fruit and vegetable intake were correlated. Of the two studies that did not find a correlation, both found a correlation between availability and intake in a portion of their sample. One study found that the correlation was significant for girls, but not for

boys, while the other study showed a significant correlation for Euro-American children but not for African-American children.

Other literature reviews have reached the same conclusions. One such review examined literature from 1990 to 2005 on potential determinants of child (ages 6-12) fruit and vegetable intake (Blanchette & Brug, 2005). Determinates of fruit and vegetable intake that were related to socioeconomic status were omitted from the review, as they are often not affected through interventions. The authors found that all of the studies that had examined the influence of availability/accessibility of fruit and vegetables on consumption showed that there was a significant association between the two variables. None of the studies reviewed failed to demonstrate a significant association between availability/accessibility and fruit and vegetable intake in children.

In another review of the literature related to fruit and vegetable consumption nationally and in the state of South Carolina, the authors concluded that fruits and vegetables are more likely to be eaten if they are available in the home (Michaud et al., 2007). In reviewing the literature related to fruit and vegetable intake, the authors found that self-reported availability of fruits and vegetables is so strongly associated with intake that it can be used as a surrogate measure for intake. In addition, the authors stated that in many cases the lack of availability of produce is a barrier that negatively impacts fruit and vegetable consumption.

A seminal study in nine European countries demonstrated that availability of fruits and vegetables increases their consumption by children in other areas of the world (Brug, Tak, Te Velde, Bere, & De Bouraudhuij, 2008). The study was a cross-sectional survey of 11 year-old children in nine countries spread across the European continent. A self-report questionnaire measuring fruit and vegetable intake and its possible determinates (as determined from a literature review, focus groups, and a social-ecological model) was completed by 13,305 students. Additionally, each of those children's parents was contacted via telephone for a brief interview to

collect data from their perspective. The researchers used multilevel logistic regression to analyze the data. The results showed that availability was a predictor of vegetable but not fruit intake. Children who reported frequently having vegetables that they enjoy in their home were significantly more likely to eat vegetables daily. In addition, availability was a significantly stronger predictor for girls than for boys.

A study of Dutch adolescents (Martens, Van Assema, & Brug, 2005), ages 12-14 years, found contrasting results. The students were asked to complete a self-administered questionnaire that measured dietary intentions, attitudes, social norms, social support, self-efficacy, family food rules, fruit availability, information regarding demographic traits, and fruit consumption. Two-hundred and four students completed the survey. Using stepwise multiple regression analysis, the researchers sought to determine which factors were strongly correlated with fruit consumption. They found that, for this sample of adolescents, availability of fruits in the home was not significantly correlated with either intention to consume fruit or with actual consumption of fruit.

Programs aimed at increasing fruit and vegetable consumption have also found that availability is important. An inner-city gardening program aimed at getting children to eat more fruits and vegetables was evaluated qualitatively to determine what factors influence their food choices (Lautenschlager & Smith, 2007). The program, entitled the Youth Farm Market Project, was composed of 40 youth ages 8-13; the youth participated in cooking classes, classroom activities, and field trips. At the conclusion of the program, researchers compared the results of focus groups of participants to the results of nonparticipant focus groups. The researchers found that availability was reported in both groups as one of the main obstacles to eating fruits and vegetables. Participants in the program reported that the fresh fruits and vegetables grown at the garden were in high demand and that when everyone partook of the harvest, many felt that they didn't get enough of the fruits and vegetables that were available.

One program that was developed to help children eat more fruits and vegetables was the High 5 Alabama Project. As part of the High 5 Alabama Project (Kratt, Reynolds, & Shewchuk, 2000), 1,196 fourth-grade students and their parents completed questionnaires to measure psychosocial variables related to fruit and vegetable intake. Both the child and their parent were asked to report on the availability of fruits and vegetables in the home, and then the participants were categorized according to high, medium, and low levels of availability. To assess the child's actual fruit and vegetable intake, the researchers collected a full seven day's worth of 24-hour recalls. At this point, the researchers used multi-group structural modeling to analyze the relationship between reported home availability and fruit and vegetable intake. When the different availability groups were compared, it was found that there was a significant difference in fruit and vegetable intake between the low-availability group and the medium-availability group. There was also a significant difference in fruit and vegetable intake between the low-availability group and the high-availability group.

Other data from the High 5 Alabama Project with fourth-grade students (Hinton, 1998) demonstrated an even stronger association between availability and fruit and vegetable intake. As part of the project, 422 fourth-grade students and their parents completed 24-hour recalls and self-report questionnaires at three different points in time. First, they provided baseline data and then completed data collection again one year and two years after baseline. The questionnaires used in the study measured psychosocial factors such as outcome expectations, nutrition knowledge, self-efficacy, nutrition education, taste preference and familiarity. Parents were asked to report on the availability of fruits and vegetables in their home. In order to determine the direct and indirect effects on fruit and vegetable consumption, the researchers used linear structural relations analysis to analyze the data. The model derived demonstrated that reported availability of fruits and vegetables in the home had a direct and significant impact on the amount of fruits and vegetables eaten by the children.

The Gimme 5 program was another intervention aimed at influencing children to eat more fruits and vegetables. Hearn et al. (1998) designed an experiment to examine the concept of reciprocal determinism and how it relates to fruit and vegetable intake in children. Specifically, the researchers were interested in which environmental factors would influence the children's eating behavior. Third-grade students participating in the Gimme 5 program in an urban area in the southeastern US were used as the sample for this study. Thirteen children and their parents participated in the study. Food records were collected from the children for seven consecutive days and then a telephone interview was conducted with the child's parent who was assumed to most likely be the child's main food provider. The parents were asked about foods available in the home in the past week, which foods were accessible to the child, and about demographic information. Fruit and vegetable availability and accessibility were combined for analysis. Regression analysis was used to interpret the data. The researchers found that availability/accessibility was significantly associated with the children's weekly average fruit intake, with the children's weekday and weekly average vegetable intake, and with the children's weekend and weekly average fruit and vegetable combined intake even after controlling for such psychosocial variables as child's fruit and vegetable preferences and outcome expectancies.

The role of availability on fruit and vegetable intake may not vary between ethnic groups, as data from Texas demonstrated (Dave, 2008). Parents ( $n = 184$ ) of Hispanic children in grades one through five were asked to complete a survey addressing their child's fruit and vegetable intake and the availability and accessibility of fruits and vegetables in their home. The researchers used multiple regression analysis to discover relationships between the variables. The results indicated that there was a significant positive correlation between both home availability and home accessibility of fruits and vegetables and child's intake.

When researchers examined the relationship between availability and fruit and vegetable intake in adolescents in Missouri, the results were not as clear (Befort et al., 2006). Adolescents

( $N = 228$ ) were asked to complete a fruit and vegetable screener survey to assess intake while their parents were asked to report on home availability in a separate survey. The researchers used simple Spearman correlation and multiple regression to analyze the collected data. They found that home availability was significantly correlated with fruit consumption but not with vegetable intake. Furthermore, when the authors divided the participants by race, they found that home availability was only significantly associated with fruit intake in non-Hispanic white adolescents. The authors concluded that the associations between home availability and fruit and vegetable intake were weak in this population.

One study used qualitative information to examine how availability influenced intake (Keim, Swanson, & Cann, 2001) in Mexican-American and Caucasian third-grade students. The researchers used SCT to guide the development of the focus group questions, and then the collected data were analyzed within the constructs of SCT. Participants in the focus groups were eligible if their family participated in reduced or free school lunch programs, food stamp programs, WIC, Head Start, or if they received assistance from a food bank. Twenty-seven Caucasian and 32 Mexican-American students in Idaho participated in the study. The focus groups were recorded, transcribed, and coded with 97% intra-rater reliability. Availability to fruits and vegetables was discussed by the children as a barrier to fruit and vegetable consumption. In the Caucasian groups, 75% of the children reported not having fruits and vegetables in their home or not knowing where they were stored in the home, in contrast to only 33% of the Mexican-American children.

Focus groups with 10- to 13-year-old adolescents in Mississippi revealed similar themes (Molaison, Connell, Stuff, Yadrick, & Bogle, 2005). The questions used in the focus groups were derived from SCT constructs. Participants ( $N = 42$ ) were low-income African-American children. The focus groups were tape-recorded, transcribed, and then analyzed using content analysis methods. Lack of fruit and vegetable availability in the home was a barrier to consumption for

most of the participants. One stated, “Most of the time, we don’t have them at home...cause fruit is not something that parents just buy, just to be buying” (Molaison et al., pp. 248-249).

One study in Texas was designed using the SCT as its model (Cullen et al., 2003). As part of the study, students in fourth through sixth grades were asked to fill out a survey regarding their fruit and vegetable taste preferences and their perceived home availability of fruits and vegetables. In addition, the researchers collected seven consecutive days’ worth of food records for each of the children. The children’s parents were asked to report on their perceived availability of fruits and vegetables in the home. Two hundred and twenty-five kids and 137 parents participated. When the researchers analyzed the collected data, they found that the child’s perception of home availability and accessibility accounted for ten percent of the variance in children’s fruit and vegetable intake. Both home child-reported availability and accessibility were significant predictors of fruit and vegetable intake. However, parent-reported availability was not a significant predictor of child’s fruit and vegetable consumption.

In Georgia, researchers specifically sought to determine how the SCT construct of reciprocal determinism affected fruit and vegetable intake in young adolescents (Young, et al., 2004). The researchers asked students from three middle schools ( $N = 366$ ), grades six through eight, to fill out an anonymous survey about their home fruit and vegetable availability and consumption and parental factors related to fruit and vegetable intake. Using hierarchical regression analysis, and controlling for confounding factors such as age, gender, socioeconomic status, and ethnicity, the authors found that perceived fruit and vegetable availability was a direct, significant predictor of fruit and vegetable intake. In addition, perceived availability had a moderating effect on other environmental factors related to fruit and vegetable intake, including perceived parent support for fruit and vegetable consumption and perceived parent modeling of fruit and vegetable consumption. However, the most remarkable result was that when the researchers controlled for all other known predictors of fruit and vegetable intake, perceived fruit

and vegetable availability had the strongest direct effect on fruit and vegetable intake of all the variables studied.

Researchers in Florida also used SCT as a basis for determining how environmental factors influence the amount of fruits and vegetables young adolescents eat (Granner, 2004). The students ( $N = 736$ ), ages 11-15 years, were asked in a survey about their regular fruit and vegetable intake, and the social, personal, and environmental factors related to fruit and vegetable consumption. The researchers measured home availability and access to fruits and vegetables as one construct. Using the results, the researchers grouped the students according to fruit and vegetable intake (high, medium, and low), and then compared the differences between groups. The researchers found that there was a significant difference in reported home availability between each of the groups (high, medium, and low). The size of the difference varied across the different levels of intake, but the authors noted that reported home availability was the most consistent associate of fruit and vegetable eating patterns of all the variables measured.

There is some research indicating that SCT constructs, including availability, are related to fruit and vegetable intake in different areas of the world. A study designed to examine the constructs of SCT and their relation to fruit and vegetable intake used data collected from the “Fruits and Vegetables Make the Marks Project” in sixth- and seventh-grade students in Norway (Bere & Klepp, 2004). Students ( $n = 1950$ ) and parents ( $n = 1647$ ) participated in the study. Students were asked to fill out a questionnaire assessing fruit and vegetable intake, food skills, availability of fruits and vegetables, and personal factors including self-efficacy, food preferences, intention to eat fruits and vegetables, and awareness of current dietary guidelines. Parents’ surveys provided data about the students’ fruit and vegetable intake, parent’s intake, availability of fruits and vegetables for the child, and child’s food preference. Multiple regression was used to assess the data. child’s and parent’s reported availability of fruits and vegetables were combined into a composite accessibility score for data analysis. Availability of fruits and



vegetables was significantly correlated with the students' fruit and vegetable consumption. Additionally, the researchers found that availability contributed the highest amount of unique variance to the model which included all of the variables thought to be correlated to fruit and vegetable intake.

Although there have been several studies on availability of fruits and vegetables and children's intake, there have not been many studies that have examined this relationship in adolescents. However, one group of researchers sought to apply SCT constructs with a group of adolescents using a program entitled Project EAT. Project EAT (Eating Among Teens) was a large prospective study of adolescents designed to help researchers understand the social-environmental, behavior, and personal factors related to fruit and vegetable intake (Arcan et al., 2007; Hanson, Neumark-Sztainer, Eisenberg, Story, & Wall, 2005; Larson et al., 2008; Neumark-Sztainer et al., 2003). Project EAT was grounded in SCT, which was used to determine the type of data to collect. Project EAT was administered in both middle- and high-schools, and was executed in three major urban areas in Minnesota.

In order to derive a model that best explained adolescent fruit and vegetable intake, 3,957 adolescents (mean age 14.9 years) were asked to complete the Project EAT survey that addressed social, environmental, and personal factors and assessed fruit and vegetable intake through the Youth and Adolescent Food Frequency Questionnaire (Neumark-Sztainer et al., 2003). Home availability was assessed by asking participants whether they had specific foods in their homes in the past week. Fruit and vegetable consumption was measured using the validated Youth and Adolescent Food Frequency Questionnaire. When the researchers analyzed the survey results using structural equation modeling, they found that home availability of fruits and vegetables was one of only two factors that were statistically and meaningfully significant predictors of fruit and vegetable intake. Additionally, home availability was the strongest single predictor of fruit and vegetable consumption.

A subsample of the Project EAT participants was selected to participate in a more extensive study (Hanson et al., 2005). Nine hundred and two adolescents who had completed the Project EAT questionnaire had their parents participate in the study via telephone interviews with the researchers. The parents were asked about home fruit and vegetable availability using a validated instrument from a different study (Neumark-Sztainer, Croll, Story, Hannan, French, & Perry as cited in Hanson et al., 2005). Using these data, the researchers were able to see different trends. Fruit and vegetable intake was significantly positively associated with parents' reported home availability for girls, but not for boys. The researchers calculated that in homes where fruits and vegetables were always available, girls consumed 1.3 more servings of fruits and vegetables per day than girls in homes where fruits and vegetables were either sometimes or never available.

Five years after the initial Project EAT survey, participants were mailed a follow-up survey to further research the factors influencing diet patterns of young adults (Arcan et al., 2007). The follow-up survey was the same as the original survey. Participants who responded to the survey were classified as two separate cohorts based on whether they had been in middle school or high school at baseline. The follow-up survey therefore assessed the differences between middle-to high school and from high school to young adulthood.

Using the data collected from 509 Project EAT participants who responded to the follow-up survey, general linear modeling was used to analyze which factors most influenced fruit and vegetable intake. The researchers found that for both cohorts (middle- and high school), home availability of fruits and vegetables at baseline was not significantly associated with fruit and vegetable consumption at follow up (Arcan et al., 2007).

However, when researchers selected a larger sample, they found different results (Larson et al., 2008). The researchers collected follow up surveys from 1,495 young adults who were in high school at baseline, but were young adults (mean age 20.4 years) at follow up. Using multi-linear regression models, the researchers found that home fruit and vegetable availability at

baseline was positively associated with follow-up intake of fruits and vegetables in both genders. Additionally, fruit and vegetable availability at baseline was significantly correlated with longitudinal increases in fruit intake in young men, but not in young women (Larson et al.).

While Project EAT provided excellent data on adolescents and young adults, there is a lack of data on college students and how availability impacts their fruit and vegetable intake. Only one study examined this relationship, using a sample of undergraduate college students at Middle Atlantic University (Harris & Murray, 1997); the researchers found that availability may be a pertinent construct even in the college setting. Using a questionnaire that measured 22 constructs based on SCT, the researchers sought to determine what factors most significantly impact college students' dietary habits. One-hundred ninety-one students, average age of 20 years, completed the self-report questionnaire. Using stepwise multiple regression analysis, the researchers found that those students who reported availability of fruits and vegetables at their place of residence also reported higher fruit and vegetable consumption. In fact, availability was the most significant predictive variable in the regression model, indicating that it had the most impact on fruit and vegetable intake.

The researchers also found that place of residence and meal plan participation may impact the fruits and vegetables available, thereby influencing fruit and vegetable intake. Students who lived in dormitories ate significantly more fruits and vegetables than students living in apartments or fraternity and sorority houses. Students who had either no meal plan or a full meal plan ate more fruits and vegetables than those students who only had a limited-access meal plan (Harris & Murray, 1997).

The results from these studies provide considerable evidence that home availability may have a substantial effect on fruit and vegetable consumption in children (Bere & Klepp, 2004; Cullen et al., 2003; Young et al., 2004) and in young adolescents (Hanson et al., 2005; Neumark-Sztainer et al., 2003). However, there are few studies on home availability and fruit and vegetable

consumption in college students (Harris & Murray, 1997). Although the results of these studies imply that availability may influence college students' fruit and vegetable intake, the results should be replicated by other scientific studies to strengthen the evidence.

### Behavioral Capability: Nutrition Knowledge

The SCT construct of behavioral capability states that a person must have the knowledge and skills related to a behavior in order to successfully perform the behavior (Bandura, 1991). Knowledge of basic nutrition principles may be necessary to perform dietary behaviors such as choosing to eat fruits and vegetables. The studies in this section examine the relationship of nutrition knowledge and fruit and vegetable intake.

One author conducted a review of the literature related to nutrition knowledge and its effects on food consumption (Worsley, 2002). The author did not state his research methods. However, after reviewing the literature available, Worsley found that the research in this area shows conflicting results. He theorized, based on the results of the studies reviewed, that knowledge is necessary in changing dietary behavior, but that it is not sufficient to change behavior. He also found several reasons why nutrition knowledge may not be linked to diet habits in the literature. First, he found that there is an inconsistent and poor conceptualization of nutrition knowledge such that different researchers are measuring different facets of knowledge and skill and all calling it "nutrition knowledge." Thus, when different studies find different results it may be because the studies have actually measured different constructs.

Another reason that studies on nutrition knowledge and dietary habits have shown conflicting results is due to the fact that there is a lack of validated instruments designed to measure nutrition knowledge. Worsley (2002) found that in most of the studies he reviewed, the authors had developed their own instrument to measure nutrition knowledge. He also noted that

most of these instruments were not tested beyond a cursory pilot test, which does not sufficiently demonstrate that the instrument is reliable or valid.

A third problem with studies trying to examine the link between nutrition knowledge and dietary habits is that most of the studies have been too small to discern any small relationships that may exist. Even if nutrition knowledge does have a consistent, but small, effect on dietary behavior, most of the studies in this area have not had the statistical power to uncover a small relationship (Worsley, 2002).

In a different article reviewing the literature pertaining to factors that influence fruit and vegetable intake (Blanchette & Brug, 2005), researchers found similar results. The studies that were included in this review, representing almost a full decade of research, showed conflicting results. While some showed that there was a positive relationship between knowledge and fruit and vegetable intake, others showed no relationship at all. The researchers hypothesized that the conflicting results could be due to the fact that nutrition knowledge is measured differently in each of the studies, and that the different instruments used may actually be measuring different facets of nutrition knowledge. For the purpose of this study, nutrition knowledge will be defined as a basic understanding of current dietary recommendations and nutrients provided by foods as well as knowledge of diet-disease relationships (Parmenter & Wardle, 1999).

Several interventions have aimed at increasing children's nutrition knowledge in order to positively impact fruit and vegetable intake. In Florida, a three-year nutrition education program for elementary students was assessed to determine the influence on children's fruit and vegetable intake (Ellis, 2008). The program was based on five different theories, one of which was SCT. Components of the program included a classroom education and activity portion, a cafeteria intervention, the use of real-life nutrition experiences to teach mathematics, and parental involvement. Children ages 5 to 11 years at baseline participated in the study by completing questionnaires assessing dietary intake, body mass index (BMI) and nutrition knowledge at

baseline, nine months later, 18 months after baseline, and 27 months after baseline. Fifty-eight students completed the full assessment all four times and were the sample for the study. Using univariate repeated measures analysis, the authors assessed the efficacy of the program on the children's dietary habits. The researchers found that there was a significant increase in both fruit and vegetable intake from baseline to the final assessment. The authors did not report any analysis of changes in nutrition knowledge, nor did they attempt to analyze whether any increases in nutrition knowledge were correlated with, or responsible for, the changes in fruit and vegetable intake.

The High 5 Alabama program was another intervention that sought to increase nutrition knowledge. The researchers evaluated the program to determine which factors could have a mediating effect on children's fruit and vegetable consumption (Reynolds et al., 2002). The "High 5" program, which was based on SCT constructs, was implemented in 14 elementary schools, with matched schools serving as controls. Children and their parents were assessed at the "kick off" night of the program, one year later, and two years after baseline. The assessments for the children included seven consecutive days of 24-hour recalls, and a questionnaire measuring self-efficacy, outcome expectancies, nutrition knowledge, and social norms. For the parents, assessments included a self-report questionnaire measuring their fruit and vegetable intake, availability of fruits and vegetables in the home, and how often the family ate meals together.

To be a mediating factor, a variable had to meet four criteria. First, the intervention had to cause the outcome variable (in this case, the "High 5" program had to increase children's fruit and vegetable intake). Second, the intervention had to cause the mediating factor (e.g. the "High 5" program had to result in increased nutrition knowledge in the children). Third, the mediator had to cause the outcome when the intervention was controlled for (e.g. increased nutrition knowledge had to increase fruit and vegetable intake when the effects of the "High 5" program

were controlled). Fourth, the mediated effect had to be statistically significant (Reynolds et al., 2002).

The researchers found that three of the four criteria were met by nutrition knowledge. First, the “High 5” program did result in a significant increase in the children’s fruit and vegetable intake. Second, the “High 5” program resulted in significant increases in children’s nutrition knowledge from baseline to year one and year two. Third, increases in nutrition knowledge were significantly correlated with increased fruit and vegetable intake when using a single-mediator model. However, the mediated effect of nutrition knowledge on fruit and vegetable intake did not reach statistical significance (Reynolds et al., 2002).

Other researchers from the “High 5” program looked at nutrition knowledge and fruit and vegetable intake in a different way (Hinton, 1998). Using data from 422 fourth-grade students, they found that the children’s nutrition knowledge had a significant direct effect on fruit and vegetable consumption.

Using national data from the Continuing Survey of Food Intake by Individuals, other researchers also asked whether nutrition knowledge had a mediating effect on factors related to dietary intake (Beydoun & Wang, 2008). Adults ages 20-65 years ( $N = 4356$ ) participated in the study by completing multiple 24-hour recalls and a questionnaire assessing nutrition knowledge, personal perceptions and beliefs, socioeconomic status information, demographic information, and other “health parameters.” The participants were divided into three groups according to level of nutrition knowledge. Using these groups, the researchers used stratified regression to analyze the data. They found that nutrition knowledge did have a significant modifying effect on socioeconomic characteristics’ association with fruit and vegetable intake. The effect was such that education and income were more strongly correlated with fruit and vegetable intake in the groups with more nutrition knowledge. This study indicates that even if nutrition knowledge

does not have a direct effect on fruit and vegetable intake, it may have a mediating effect on other variables that do influence fruit and vegetable consumption.

Qualitative data from adults also demonstrate that nutrition knowledge and fruit and vegetable consumption may be related. One qualitative study in the eastern US found that nutrition knowledge, and particularly knowledge about the benefits of fruit and vegetable consumption, affected fruit and vegetable intake (Ming-Chin et al., 2008). One hundred forty-seven adults from a wide ethnic background participated in focus groups in either North Carolina or Connecticut. All of the focus groups were audio recorded, transcribed and coded using qualitative analysis software. The key facilitating factor to fruit and vegetable intake was knowledge about the health benefits of fruits and vegetables. The participants indicated that this knowledge motivated them to try and eat more fruits and vegetables. This appeared to be true across all of the ethnic groups (African American, Hispanic, and Caucasian) represented in the study.

International data also illustrate that nutrition knowledge may be associated with fruit and vegetable intake in children. A cross-sectional survey study in nine European countries was conducted to discover possible determinants of children's fruit and vegetable intake (Brug et al., 2008). The researchers found that in this sample, both daily fruit intake and daily vegetable intake were significantly correlated with knowledge of recommendations for fruit and vegetable intake. They also found that knowledge of recommendations for fruit and vegetable intake was a significant predictor of fruit intake in nine of the countries studied (100%) and of vegetable intake in six of the countries studied (67%).

A study in London indicated that a mother's nutrition knowledge could significantly impact a child's fruit and vegetable intake (Gibson et al., 1998). Ninety-two mothers with children ages 9-11 were interviewed to gather data regarding their health behaviors, socioeconomic status, nutrition knowledge (which was a composite of knowledge of dietary



recommendations, nutrition content of foods, and practical knowledge), beliefs and attitudes, and food preferences. The mothers were also asked to fill out a food frequency questionnaire for their child. The children were interviewed separately in order to obtain information regarding their nutrition knowledge (based solely on their knowledge of the nutrient composition of foods), beliefs and attitudes, and food preferences. Using regression analysis, the researchers found that there was a significant, strong positive relationship between the mother's nutrition knowledge and the child's fruit intake. However, no relationship was found between mother's nutrition knowledge and child's fruit juice or vegetable intake. Additionally, the child's nutrition knowledge was not related to fruit, fruit juice, or vegetable consumption.

Another study in London also sought to determine whether nutrition knowledge affects food intake (Steptoe et al., 2004). This study involved 271 adults ages 18-71 years in a parallel-group randomized trial. The experimental group received two 15-minute nutrition education counseling sessions over a two-week period of time, while the control group received an equal amount of behavioral dietary counseling during the same period of time. Assessments of nutrition knowledge and fruit and vegetable intake (using a food frequency questionnaire) were completed at baseline, eight weeks later, and 12 months following baseline. Multiple linear regression was used to analyze predictors of fruit and vegetable intake. The results demonstrated that a change in knowledge from baseline to eight weeks was a significant predictor of increased fruit and vegetable intake at 12 months following baseline. To contrast these findings, the researchers found that baseline nutrition knowledge was not a significant predictor of fruit and vegetable intake at 12 months following baseline.

In addition to European studies on children's nutrition knowledge and fruit and vegetable intake, a study in Taiwan was conducted to examine the same relationship. Two thousand four hundred and seventeen Taiwanese students participated in the national Nutrition and Health Survey in Taiwan Elementary School Children (Wei et al., 2007). Participants, children in grades

one through six, were asked to complete a 24-hour recall and a food frequency questionnaire at home with the help of their parents. Additionally, the children completed a survey at school that measured nutrition knowledge, attitude, nutrition-related eating behavior, restraint eating behavior, and general eating behavior. The children were divided into age groups, first through third grades and fourth through sixth grades, for analysis. The researchers gave each participant a dietary quality score, based on whether they met key dietary recommendations (including fruit and vegetable recommendations), and used Pearson correlations to determine if any of the constructs measured by the survey were related to dietary quality. They found that there was a significant, but weak, positive correlation between nutrition knowledge and dietary quality score in both age groups of children.

Studies that have examined the relationship between nutrition knowledge and fruit and vegetable consumption in adults have found similar results. In North Carolina, a sample of African American adults ages 18-70 years were assessed to determine whether knowledge of the current recommendations for fruit and vegetable intake affected actual intake (Watters, et al., 2007). Six hundred fifty-eight participants responded to a mailed questionnaire that assessed demographic, lifestyle, dietary and behavioral factors in addition to diet-related psychosocial factors. Using multiple linear regression, the researchers sought to determine which factors had the most effect on fruit and vegetable consumption. They found that knowledge of the current recommendations for fruit and vegetable intake was significantly associated with fruit and vegetable intake, even after controlling for age, education, BMI, and all other statistically significant psychosocial factors in the study.

A study that used a validated nutrition knowledge questionnaire found even more striking results (Wardle et al., 2000). Adults, ages 18-75 ( $N = 1040$ ) living in the United Kingdom, completed the nutrition knowledge questionnaire, the Dietary Instrument for Nutrition Education (to assess fruit and vegetable intake), and a survey assessing demographic factors. Using Pearson

correlation, the researchers found that in this sample, nutrition knowledge was significantly associated with both fruit and vegetable intake. When multiple regression was used, nutrition knowledge had an independent association with both fruit and vegetable intake, independent of demographic variables (such as level of education and socioeconomic status) that have been shown to be related to fruit and vegetable intake. The authors suggested that nutrition knowledge had a mediating effect on some socioeconomic variables such that nutrition knowledge may explain some of the differences between socioeconomic groups' eating of fruits and vegetables. When an effect size was calculated, the researchers reported that those participants in the highest quintile of nutrition knowledge were almost 25 times more likely to eat the recommended servings of fruits and vegetables than those in the lowest category of nutrition knowledge.

Although there have been some studies utilizing an adult population, there is very little research on the way college students' nutrition knowledge is related to fruit and vegetable intake. One study that did examine this relationship in college students used an internet-based survey of college students in Virginia (methods discussed previously) (Kolodinsky et al., 2007). Nutrition knowledge was assessed using a series of statements about dietary guidelines. Participants were asked to respond to the importance of the dietary guideline statements using a Likert scale ranging from "very important" to "not at all important." The researchers found that those students who reported eating more than the recommended levels of fruits scored significantly higher on the knowledge scale than did those students who ate less than the recommended amount of fruits. However, there was no significant relationship between nutrition knowledge and vegetable consumption.

The studies in this section have yielded conflicting results as to whether nutrition knowledge has any effect on fruit and vegetable intake. Many of these studies have involved children, who may not have the opportunity to select and prepare the foods that they consume; thus, a higher level of nutrition knowledge in that population may not influence the behavior of

eating more fruits and vegetables due to a lack of control and involvement in selection and preparation of foods.

Only a handful of studies have examined the relationship between nutrition knowledge and fruit and vegetable intake in adults. Only one of these studies did not find a significant association between knowledge and consumption. However, the only study of college students found that there was no significant association between nutrition knowledge and fruit intake. More research is needed in this area to clarify the role that nutrition knowledge plays in the consumption of fruit and vegetable intake in college students.

#### Behavioral Capability: Food Preparation Ability

Many of the studies that have sought to determine how food preparation influences fruit and vegetable intake have targeted at-risk populations, including elderly men, low-income adults, and children. Several studies have looked at elderly men in order to determine if and how food preparation skills can influence fruit and vegetable intake (Holmes et al., 2008; Hughes et al., 2004; Keller, Gibbs, Wong, Vanderkooy, & Hedley, 2004).

A cooking group organized for men at a senior recreation center in Ontario was designed to increase the men's ability to prepare food, plan healthy menus, and increase their basic nutrition knowledge (Keller et al., 2004). The group met for 2 hours, once a month, for 8 months of the year. During the second year after the group's initiation, the directors of the program conducted an evaluation of the program's success using written questionnaires and key informant interviews. A total of 19 men completed the questionnaire and 10 of these were interviewed. All of the men were over 65 years of age, and 60% of them were over the age of 75 years. The directors of the program did not directly evaluate dietary intake, but found qualitative evidence that the cooking group had changed the men's diet habits. Most of the men reported that they had learned how to increase the variety in their diet, and many commented that they used more fruits

and vegetables in their cooking. One man said, “Your mind is more on healthier cooking and a healthier way to eat. I don’t buy all that much canned food and I buy more vegetables now, more fruit, and watch my bread and buy seven-grain instead of just white bread” (Keller et al., p. 80).

In a study involving poor, elderly men, researchers found that greater food preparation ability may positively influence fruit and vegetable intake (Holmes et al., 2008). Two hundred and thirty-four men, all over the age of 65 years and identified as being in the lowest 15% of the United Kingdom’s national income bracket, participated in the study. Each participant completed a questionnaire and diet recall, was interviewed, gave a blood sample, and was assessed for anthropometric measurements. In order to determine food preparation ability, the participants were asked to assess the skills of the main food provider as “better-developed” (being able to prepare an item from scratch without help), or “less-developed” (being unable to do so). The data collected were weighted during analysis to accurately reflect the demographics of the population.

The researchers found that in households where the main food provider had greater food preparation ability, the men were significantly more likely to consume vegetables (117 g/day versus 76 g/day). In addition, men whose food preparation was not limited by illness had significantly higher intake of fruit (96 g/day versus 57 g/day) than those who were limited by illness (Holmes et al., 2008). This study indicates that increased food preparation ability enhances vegetable intake, but that limiting food preparation ability may have a negative impact on fruit intake.

Another study of elderly men found similar results (Hughes et al., 2004). Thirty-nine men ages 62 to 94 years in an urban area in Northwest England completed a questionnaire and diet recalls and were interviewed. All of the participants lived alone, but had access to kitchen facilities and did not rely totally on others for their meals. The men’s cooking skills were self-assessed and categorized as “no/poor,” “adequate,” or “good.” The researchers found that men with “good” cooking skills consumed significantly more vegetables than men with “no/poor”

cooking skills. In correlation analysis, the researchers found that cooking skill was significantly positively correlated with servings of fruits and vegetables consumed. Since none of the men in the study met current recommendations for fruit and vegetable intake (five servings/day), the researchers chose to compare those with the highest intake (>four servings/day) to those with the lowest intake (<one serving/day) in order to find differences between the groups.

A cooking class intervention in Scotland demonstrated that an increase in food preparation skills may positively impact fruit and vegetable intake (Wrieden & Symon, 2003). The intervention was a 7-week program implemented at different sites, but all based on the same “CookWell” curriculum. Ninety-three adults were assigned to either the intervention or comparison groups; only 63 participants completed the entire program. Participants were asked to complete food and shopping diaries and a questionnaire three times: at baseline, immediately following the program, and 6 months later. Immediately following the program, the researchers found a significant difference in fruit intake between the intervention and comparison group. The intervention group consumed the equivalent of one extra serving of fruits per week when compared to the control group. There were no other significant differences seen at that time. At follow-up, 6 months later, the researchers found that this positive change in fruit consumption was not sustained; there were no significant differences between the groups at this time. The researchers noted that the sample size of this study was probably too small to detect slight dietary changes.

In Oklahoma, the Cooperative Extension Service provided a program for youth and adults to learn basic fruit and vegetable preparation skills (Brown & Hermann, 2005). Participants completed questionnaires both before and after attending eight hands-on demonstration classes during a two-month period. The average age of youth participants was 12 years ( $n = 229$ ) and the average age of adult participants was 57 years ( $n = 373$ ). Comparing pre- to post-program

questionnaires, the researchers found that the average number of fruit servings and vegetable servings both significantly increased in the youth and the adults.

Low-income adults are an at-risk population that has been studied in regards to food preparation and fruit and vegetable intake. Researchers in Canada conducted a study to determine if at-home food preparation influenced dietary quality in low-income women (McLaughlin et al., 2003). Participants in the study had all used a food assistance program at least once in the past year and were selected from a random sample of food assistance programs. The women ( $N = 153$ ) ranged in age from 19 to 49 years. None of the women in the study were pregnant, but all had at least one child under the age of 15 years living at home. Data were collected from the women through a series of 24-hour recalls and oral interviews. To assess food preparation activity, participants were asked to indicate whether foods reported in the 24-hour recalls were prepared at home or not. If the food was prepared at home, the participants were asked to write the recipe used to prepare the food. From this information, researchers were able to classify food as being prepared at home from scratch or not. Food prepared from scratch was defined as dishes that included multiple ingredients and used at least one cooking technique.

Using least squares regression to assess the data, the researchers found that each one-unit increase in frequency of food prepared from scratch over three days was associated with an increase of one serving of fruit or vegetable each day. This means that cooking from scratch once every three days increased fruit and vegetable intake by one serving each day. One limitation of this study was that many of the women in this study were limited by severe food insecurity, as determined by the results from the Food Security Model (food insecurity is determined by the frequency and duration of food deprivation for adults and children over a given time period). Because the researchers found that women with higher levels of food security also reported more food preparation from scratch, the higher levels of fruit and vegetable intake in this study could

be reflective of more food security instead of more food preparation from scratch (McLaughlin et al., 2003).

Results from studies of adolescents and young adults have also indicated that food preparation ability may enhance fruit and vegetable intake (Larson et al., 2008; Larson, Perry, et al., 2006; Larson, Story, et al., 2006). A large sample of young adults ages 18-23 years in Minnesota participated in the Project EAT survey as described earlier. For the purposes of this study, questions about food preparation and purchasing behaviors were added to the Project EAT survey. The sample size for the study was 1,710 people comprised of 764 males and 946 females (Larson, Perry, et al.).

The researchers found that although there was not a significant difference in diet quality based on perceived adequacy of food preparation ability, the participants who reported more frequent food preparation were significantly more likely to meet the Healthy People 2010 objectives for fruit and vegetable intake. Among those who reported more frequent food preparation, 31% ate five servings of fruits and vegetables a day, while only 3% of those who reported low food preparation consumed five servings of fruits and vegetables a day (Larson, Perry, et al., 2006). These results indicate that it may not be food preparation skill as much as time spent in food preparation that has a positive effect on fruit and vegetable consumption. One weakness of this study is that the instrument used to assess food preparation skills has not been assessed for validity or reliability.

The results of this study also indicate that food preparation involvement is strongly influenced by demographic traits. There were significant differences in the level of food preparation involvement based on gender, race, and living situation. Compared to males, females were almost twice as likely to be involved in food preparation activities. African American students reported much lower involvement in food preparation than any other racial group. Finally, students who lived in an apartment or house with roommates participated in food



preparation more than those who lived with their parents or in campus housing (Larson, Perry, et al., 2006).

A similar study assessed food preparation in adolescents (Larson, Story, et al., 2006). Trained staff visited 31 schools to assess anthropometrics and administer the Project EAT questionnaire to 4,746 students ages 11-18 years. The sample was 50.2% male and 49.8% female. The data were adjusted for socio-demographic characteristics, frequency of family meals, and total energy intake. Participants who reported caloric intake less than 400 calories/day or more than 7000 calories were excluded from analysis, as these caloric levels are implausible. Using general linear modeling, the researchers found that food preparation was significantly associated with fruit intake in males and fruit and vegetable intake in females. In addition, adolescents who reported having prepared food seven times in the past week had an average of greater than one and one-half servings of fruits and vegetables per day more than those students who reported never having prepared food.

Using data from the Project EAT follow-up survey, as described earlier, researchers found that food preparation activity may impact fruit and vegetable intake over time (Larson et al., 2008). Using data from the 1,495 young adults who participated in Project EAT in high school and responded to the follow-up survey 5 years later, the researchers found that in young women, but not in young men, food preparation involvement at baseline was positively associated with follow-up fruit and vegetable intake and longitudinal increases in vegetable intake (Larson et al., 2008).

Studies with children from other countries and different ethnic groups provide additional insight into the association between food preparation ability and fruit and vegetable consumption. In a study grounded in SCT in Norway (methods described earlier), researchers measured behavioral skills (such as ability to cut up fruits and vegetables) in order to determine whether such skills were correlated with fruit and vegetable intake in children (Bere & Klepp, 2004). They

found that behavioral skills were significantly correlated with fruit and vegetable intake.

Behavioral skills related to food preparation, as well as preference and accessibility, was one of the most strongly correlated variables to fruit and vegetable intake (Bere & Klepp).

Focus groups of Mexican-American and Caucasian children demonstrated that food preparation ability may not be an important factor in child fruit and vegetable consumption (Keim et al., 2001). The methods of this study, involving children ages 8-11 years, were described earlier. During the focus groups, the children talked about their behavioral capability in relation to fruit and vegetable intake. Even though they mentioned tasks such as peeling, cutting, chopping, and coring fruits and vegetables, very few of the children reported actually engaging in these tasks: none of the Caucasian and half of the Mexican-American children reported that they prepared their own fruits and vegetables.

An intervention entitled the “Cooking up Fun” program was designed based on SCT constructs (Condrasky, Corr, & Cason, 2006) and was targeted toward adolescents in an effort to improve diet quality. Twenty-four adolescents, ages 11-14 years participated in five full-day sessions of the program. The program focused on menu planning, food safety, nutrition, and food preparation. The adolescents were given a questionnaire before and after participating in the program, and the researchers conducted focus group interviews to gather even more information. Fruit and vegetable intake was not measured, but one item on the questionnaire indirectly assessed fruit and vegetable intake and showed that there was a significant change from pre- to post-program. The item, “I almost always eat vegetables every day,” was rated positively by only 63% of the students before the program, and 83% of the students after the program (Condrasky et al.).

Relatively few studies have considered the association of food preparation ability and its relationship to fruit and vegetable intake, but the results have been promising: many of the studies indicate that an increase in food preparation ability (Bere & Klepp, 2004; Hughes et al., 2004;

Larson et al., 2008) or time spent in food preparation (Larson, Perry, et al., 2006; Larson, Story, et al., 2006) positively impact fruit and vegetable consumption. The few studies that have examined this association in young adults have found a positive relationship between food preparation and fruit and vegetable intake (Larson et al., 2008; Larson, Perry, et al., 2006; Larson, Story, et al., 2006), but studies on college students are lacking.

### Cooking Self-Efficacy

Very few studies have examined cooking self-efficacy and its relation to dietary intake. However, many studies have shown that self-efficacy related to healthy eating (one's confidence in their ability to perform behaviors necessary to make healthy food choices) may influence fruit and vegetable consumption.

Some studies (Keller et al., 2004; Wrieden et al., 2007) indicate that cooking self-efficacy increases as food preparation ability increases. Keller et al. conducted a study of elderly men in Ontario. The study was described earlier. From baseline measurements to follow-up assessments, there were statistically significant differences in the proportion of men who reported "I am confident that what I cook will 'turn out'" and those who reported "I have good cooking skills."

In community cooking classes in Scotland (methods described earlier) (Wrieden et al., 2007), participants were asked to rate their cooking confidence on a scale from "very confident" to "not at all confident." These categories were collapsed to create two groups labeled "confident" or "not confident or don't know." The results of the study showed that there was a significant increase in percentage of participants reporting confidence in following a recipe, cooking from basic ingredients, cooking soup, and making white sauce both immediately after the program and at six months after the program. Qualitative results indicated that participants felt more enthusiastic and adventurous in their food preparation (Wrieden et al.).

There is some evidence that many people lack cooking self-efficacy. In a review of literature related to cooking skills, the authors reported on data collected during a 1993 English Health and Lifestyles Survey (Caraher & Lang, 1999). The data were collected through a poll of 7- to 16-year-old adolescents in the United Kingdom. The results of the poll indicate that confidence in food preparation lags behind confidence in other areas. When asked whether they were confident or not confident at particular skills, 93% of the participants reported being confident at playing a computer game, while only 38% reported being confident in baking a potato in the oven. The participants felt more confident in technologically-related food skills; 60% of the participants were confident they could heat a pizza in the microwave.

Only two studies have sought to examine the association between cooking self-efficacy and fruit and vegetable consumption. One of these studies was conducted in England. A sample of 1,049 women, ages 16-34 years, participated in a study to determine if cooking confidence was associated with fruit and vegetable intake (Lawrence et al., 2000). The participants were randomly selected to be a nationally representative group. Participants were asked to complete the DINE questionnaire to assess normal fruit and vegetable intake. They were also asked how confident they felt about cooking using basic ingredients instead of convenience foods. They could select “very confident,” “fairly confident,” “not very confident,” or “not at all confident.” Based on reported fruit and vegetable intake, the participants were divided into groups of high intake and low intake. When the two groups were compared, the researchers found that there was a statistically significant difference in cooking self-efficacy between women who were in the high intake and low intake groups, such that women who ate more fruits and vegetables also reported being more confident in their cooking.

The other study investigating the relationship between cooking self-efficacy and fruit and vegetable intake utilized a sample of adolescents. As part of the Project EAT study, this study sought to establish a link between perceived adequacy of food preparation skill and dietary intake

(Larson, Perry, et al., 2006). The methods were described earlier. Statistical analysis revealed that there were no significant differences in dietary quality according to participants' cooking self-efficacy. However, the researchers did find that there were differences in cooking self-efficacy between gender groups; more women than men considered their cooking skills to be adequate (81.7% versus 76.8%).

Although very few studies have examined cooking self-efficacy in relation to fruit and vegetable intake, many studies have sought to determine how self-efficacy related to healthy eating is related to fruit and vegetable consumption. In a review of literature about potential determinants of fruit and vegetable intake in children (Blanchette & Brug, 2005) (methods described earlier), the author noted that the research regarding the influence of self-efficacy on fruit and vegetable intake has yielded conflicting results. However, the author noted that interventions aimed at teaching simple cognitive and behavioral skills, which might increase self-efficacy, do influence fruit and vegetable intake in children.

It has been suggested that self-efficacy may not directly impact fruit and vegetable intake, but that it may act as a mediating factor instead (Reynolds et al., 2002). When that hypothesis was tested empirically, using methods described earlier, researchers found that self-efficacy to consume fruits and vegetables did not meet the criteria for mediating variables. Of the four criteria established for mediating variables, self-efficacy met two criteria: the intervention caused a change in self-efficacy and an increase in self-efficacy was related to increased fruit and vegetable consumption in participants. However, the intervention did not result in an increase in self-efficacy, nor was the effect of self-efficacy on fruit and vegetable intake significant when the impact of the intervention was controlled for.

One study demonstrated that self-efficacy may not be associated with fruit and vegetable intake in children until they have some responsibility and control over their choices and actions (Zabinski et al., 2006). Adolescents ages 11-15 years ( $n = 839$ ) completed an online

questionnaire while their parents filled out a pencil-and-paper survey. The parent survey assessed lifestyle strategies and household eating rules, while the adolescent questionnaire assessed decisional balance, self-efficacy, family and peer influence, and self-reported height and weight. Fruit and vegetable intake was measured through three 24-hour recalls. The respondents were categorized as “older” (adolescents age 13-15) or “younger” (ages 11-12) for analysis. Hierarchical multivariate linear regression was used to analyze the data. In the “older” group, self-efficacy was a significant predictor of fruit and vegetable intake, but self-efficacy was not a significant predictor in the “younger” group. The authors suggested that self-efficacy may be more pertinent when the child reaches an age where they have more choices and control in their life.

In Dutch adolescents (ages 12-14 years), self-efficacy to eat fruit was significantly correlated with intention to eat fruit, but not with actual consumption of fruit (data collection and analysis methods discussed previously) (Martens et al., 2005). However, there was very little variability in self-reported self-efficacy in this study, with most of the participants reporting very high self-efficacy. The authors suggested that this lack of variability in the construct of self-efficacy may have contributed to non-significant relationship of self-efficacy to fruit and vegetable intake.

Many studies have revealed that self-efficacy may play an important role in adults’ fruit and vegetable consumption. Adults in London responded to a self-report survey as described earlier in order for researchers to evaluate dietary self-efficacy’s effect on fruit and vegetable intake (Steptoe et al., 2004). The researchers found that a positive change in dietary self-efficacy from baseline to 8 weeks significantly predicted increased fruit and vegetable intake at 12 months. However, baseline self-efficacy was not a significant predictor of fruit and vegetable consumption at 12 months. Another study looked at African-American adults in North Carolina, ages 18-70 years. Participants completed questionnaires as discussed earlier (Watters et al.,

2007). Multiple regression analysis revealed that healthy eating self-efficacy was significantly associated with fruit and vegetable intake. Furthermore, self-efficacy was one of the strongest predictors of fruit and vegetable intake in the entire study.

Overweight men in California were also studied regarding the impact that self-efficacy played in influencing fruit and vegetable intake. Each participant completed an online survey assessing self-efficacy for eating behaviors, decisional balance, social support, behavior change strategies, and normal fruit and vegetable intake (Hagler et al., 2007). Four hundred forty-one men, ages 22-55 years, participated in the study. Using stepwise multiple regression, the researchers found that self-efficacy for eating behaviors was significantly associated with the amount of fruits and vegetables eaten.

National data also indicate that there may be a relationship between adults' self-efficacy and fruit and vegetable intake. In conjunction with the "5 A Day for Better Health" program, a random-digit dial survey was used to assess the association between self-efficacy and fruit and vegetable intake (Van Duyn et al., 2001). The sample represented U.S. adults ages 18 and older and was comprised of 2,525 participants. Participants responded to a 15-minute, computer-assisted telephone survey assessing social, demographic and health-related characteristics as well as psychosocial factors and usual fruit and vegetable intake. Using multiple regression and controlling for covariates such as age, sex, income, and BMI, the researchers found that self-efficacy did have strong associations with fruit and vegetable consumption. Self-efficacy was significantly correlated with total fruit and vegetable, fruit, vegetable, fruit juice, and non-fried potato intakes. In fact, self-efficacy was one of the two factors most strongly associated with total fruit and vegetable intake.

Since self-efficacy is a key component of SCT, many of the studies on the relationship between self-efficacy and fruit and vegetable intake have been based on the SCT. One such study (Hinton, 1998) involved fourth-grade students in Alabama (methods described earlier). In

analyzing the data collected, the researchers composed four different models of how different factors influenced fruit and vegetable intake and then tested the models for goodness-of-fit. They found that self-efficacy to eat fruits and vegetables was a direct significant predictor of fruit and vegetable intake in only one of the four models. They suggested that this may indicate that self-efficacy is only important for a certain subset of children, or that it may not be as important in children as it is in adults.

Researchers in Norway found different results in their study on sixth- and seventh-grade students (methods discussed previously). In the study by Bere and Klepp (2005), the adolescents' reported self-efficacy to eat five servings of fruits and vegetables per day was significantly correlated with fruit and vegetable intake. Granner's (2004) study of fourth-grade students produced similar results (methods described earlier). Analysis of the data in this study revealed that there were significant differences in self-efficacy between each of the categorical groups based on fruit and vegetable intake.

Other international data provide more insight. In the study of children from nine European countries (Brug et al., 2008) (methods discussed previously), self-efficacy to eat fruits and vegetables was significantly correlated with daily fruit intake and daily vegetable consumption. In addition, self-efficacy was a significant predictor of fruit intake in seven of the nine countries studies, and was a significant predictor of vegetable intake in five of the nine countries studied. Gallaway and other's (2007) study of 11- to 14-year-old Boy Scouts in Texas demonstrated different results. This study found that fruit and vegetable self-efficacy was significantly associated with vegetable intake, but not fruit or juice intake (methods described earlier).

Researchers in Iran studied self-efficacy for healthy food choices and fruit and vegetable intake in 14-19 year-old adolescents (Omidvar, Ghazi-Tabatabaie, Eghtesadi, Harrison, & Minaie, 2003). Participants were randomly selected and given a self-administered anonymous



questionnaire that measured dieting and exercise practices, self-efficacy, locus of control, behavioral expectation, social status, BMI, and usual fruit and vegetable intake. Using logistical regression analysis, and controlling for age, gender, and BMI, the researchers found that self-efficacy for healthy food choices was strongly associated with both fruit and vegetable consumption.

Intervention studies aimed at increasing self-efficacy in order to influence fruit and vegetable intake have also demonstrated that self-efficacy may impact fruit and vegetable consumption. In an intervention for African American adolescents ages 11-15 years (Wilson et al., 2002), 53 participants were randomly assigned to one of three groups. Each of the groups attended 12 weekly hour-long sessions in Virginia, but the content of the sessions differed between groups. The SCT group received nutrition education, behavior skills training, and reinforcement. The group SCT and Motivational received all of the SCT material in addition to viewing videotapes about strategic self-presentation. The third group served as a control and received only general nutrition education. The participants completed both pre- and post-intervention questionnaires assessing self-efficacy for eating behaviors, self-concept, motivation, and usual dietary intake. The researchers found that self-efficacy for eating behaviors was significantly correlated with both post-test fruit and vegetable intake and with change in intake from pre- to post-intervention, but only in the SCT and Motivational group. There were no significant associations between self-efficacy and fruit and vegetable intake in either of the other groups. The authors suggested that this may mean that the strategic self-presentation videos may have positively influenced self-efficacy differently than the SCT-only intervention.

Another intervention in Virginia, targeted at adults ( $N = 277$ ) found similar results. The participants were randomly assigned to either an intervention or control group (Anderson, Winnett, Wojcik, Winnett, & Bowden, 2001). The intervention was a self-administered computer-based intervention based on SCT called the Nutrition for a Lifetime System (NLS). The

intervention consisted of 15 weekly 5- to 10-minute segments focused on increasing fruit, vegetable, and fiber intake and decreasing fat intake. Participants were asked to submit a completed food frequency questionnaire, a collection of regular grocery receipts, and the NLS Food Belief Survey both at baseline and immediately following the completion of the intervention. In addition, they were asked to submit food frequency questionnaires and grocery receipts again at 4 to 6 months following the intervention. Structural equation modeling analysis was used to interpret the data. The model indicated that self-efficacy had a significant direct effect on fruit and vegetable intake at post-intervention and at follow-up. In addition, self-efficacy for buying, preparing, eating, and serving more fruits and vegetables was found to be a significant mediating factor on fruit and vegetable intake at follow-up.

The Healthy Body Healthy Spirit intervention, a church-based intervention grounded in SCT, also illustrated how self-efficacy may affect fruit and vegetable intake (Shaikh, 2007). African American adults ( $N = 965$ ) in the Atlanta, Georgia area completed baseline questionnaires assessing dietary intake, motivation, self-efficacy for eating fruits and vegetables, and social support. They were then randomly assigned to one of three groups. One group received general health information in the form of a letter, newsletter, video, and brochures. The second group received all of the same information in addition to another video, a cookbook, an exercise guide, and a cassette tape. The third group received the same materials as the second group, but also participated in four motivational interviewing phone counseling calls. One year after the materials were distributed, the participants were asked to again complete the questionnaire for post-intervention assessment. Using latent variable structural equation model analysis, the authors found that, independent of the effects of the intervention, change in self-efficacy was significantly associated with a change in fruit and vegetable intake.

Cross-sectional studies of adults have also sought to analyze the relationship between self-efficacy and fruit and vegetable consumption. Adults from Virginia, ages 18-92 years, filled

out a questionnaire assessing family social support, outcome expectation, self regulatory efficacy, and self-regulation (Anderson, Winnett, & Wojcik, 2007). In addition, they completed a food frequency questionnaire and submitted 6 weeks' worth of grocery receipts in order for the researchers to accurately determine usual fruit and vegetable intake. Using SCT as a model, latent-variable structural equation modeling was used to analyze the data. The researchers found that participants who reported higher self-efficacy were significantly more likely to report a higher intake of fruits and vegetables as compared to those with lower self-efficacy. The authors noted that most of the effect of self-efficacy on fruit and vegetable intake was indirect.

Very few studies have examined self-efficacy and fruit and vegetable intake in college students. However, in a study of young adults in Minnesota (methods discussed earlier), researchers found that baseline self-efficacy for healthy eating was significantly associated with intake of fruits and vegetables at follow-up for young women, but not for young men (Larson et al., 2008). Baseline self-efficacy significantly predicted longitudinal increases in fruit and vegetable intake for both males and females in this group.

At a university in the north-central region of the US, 294 students enrolled in introductory nutrition classes completed a survey questionnaire that measured demographic traits, health habits, self-efficacy to eat fruits and vegetables, past experience in diet change, and average fruit and vegetable intake (Chung & Hoerr, 2005). The participating students' ages were 18-24 years. Using step-wise multiple regression analysis, the researchers found that self-efficacy was only significantly correlated with fruit intake when fruit juice intake was removed from analysis in both men and women. Furthermore, self-efficacy to eat fruits and vegetables was significantly correlated with vegetable intake in women, but not in men.

There is very little research on cooking self-efficacy and its effect on fruit and vegetable intake, and the results of the studies that have been done have been conflicting (Larson, Perry, et al., 2006; Lawrence et al., 2000). However, there is some evidence that self-efficacy related to

healthy eating can increase fruit and vegetable consumption. Although some studies have found no relationship between self-efficacy and fruit and vegetable intake (Martens et al., 2005; Steptoe et al., 2004; Zabinski et al., 2006), no studies have found that self-efficacy has a negative impact on fruit and vegetable intake. Furthermore, several studies have shown that there is a positive significant relationship between self-efficacy and fruit and vegetable intake (Anderson et al., 2007; Brug et al., 2008; Omidvar et al., 2003; Shaikh, 2007).

### Summary

This chapter has reviewed the history and components of SCT and the literature related to SCT constructs and fruit and vegetable intake. Access to fruits and vegetables in the home, nutrition knowledge, food preparation skills, and cooking self-efficacy were specifically highlighted as they are the independent variables in this study. The next chapter will discuss the methodology of the current study.

## CHAPTER 3

### METHODS

The purpose of this study was to determine if social cognitive theory constructs of environment (availability in the home), behavioral capability (nutrition knowledge and food preparation skill), and self-efficacy (cooking self-efficacy) were predictive of fruit and vegetable intake in college students. The chapter covers the research design, sample and population, instrumentation, data collection procedures, and data analysis procedures.

#### Theoretical Framework

One theory that is widely used in research related to dietary habits and in planning nutrition interventions and programs is SCT. This theory encompasses a wide variety of constructs, but due to time and resource constraints, only four constructs were assessed in this study: availability of fruits and vegetables in the home (an environmental factor), nutrition knowledge and food preparation skill (behavioral capability), and cooking confidence (self-efficacy).

Because SCT is comprised of many different constructs, the studies examining SCT have often used some form of multiple regression analysis in order to understand the ways in which the varied constructs act alone and together to influence dietary intake. Multiple regression also allows the researchers to determine which of the constructs influences the outcome variable the most. The current study made use of multiple regression analysis in order to determine whether the four SCT constructs and demographic factors investigated influenced fruit and vegetable intake in college students.

## Research Design

This study utilized a self-report survey to obtain cross-sectional, single-group data from a convenience sample of college students. Survey research is known to have limitations, most notably that the data collected may not be an accurate depiction of the respondents' behavior. In addition, survey research is particularly vulnerable to recall bias and social desirability bias. However, survey research does have strengths as well, namely the ability to collect large amounts of data in a relatively inexpensive and quick manner. Even with its limitations, the survey research method was deemed appropriate for the collection of data for the current study.

Following data collection, multiple regression and descriptive statistical analysis were used to examine the relationships between availability of fruits and vegetables in the home, nutrition knowledge, food preparation skills, cooking self-efficacy, race/ethnicity, age, gender, marital status, living situation, and meal plan participation with fruit and vegetable intake using quantitative data.

## Sample and Population

The study population was comprised of college students attending on-campus classes at Utah State University in Logan, Utah during spring semester of 2009. College students were selected because even though there is ample evidence that SCT constructs are predictive of fruit and vegetable intake in children (Baranowski et al., 2000; Blanchette & Brug, 2005; Granner et al., 2004), very few studies have examined SCT constructs in relation to fruit and vegetable intake in college students.

In order to obtain sufficient statistical power to detect small changes, a power analysis was performed using SPSS 17. Using a power analysis for multiple regression with ten independent variables, an alpha level of .05, a power level of .80, and a moderate effect size ( $R^2$

value of .2), it was determined that the minimum sample size needed was approximately 200 participants. The researcher collected 209 surveys, but discarded two surveys; one survey was less than 50% complete, and the other was deemed by the researcher to have been completed facetiously. The total sample for final statistical analysis was 207 participants.

The sample for the study was a convenience sample of volunteer participants. Potential participants were invited to participate in the study during a brief orientation at the conclusion of their on-campus class on March 16 and 17, 2009. Students who wished to participate were asked to take a survey questionnaire with them and complete it on their own time during the time before the class met again. Completed surveys were collected immediately before the next consecutive class meeting time. No class time was used for data collection; participation did not influence students' success in the class. Classes were carefully selected in order to collect data from participants in a variety of different fields of study and in varying stages of their education. Classes included Intermediate Writing, Family Finance, and U.S. Institutions. These classes were selected because they meet general requirements for all USU students, regardless of major. Permission to introduce the study immediately following class was obtained from the professors of the classes. Missing data on individual items were coded as an incorrect answer for that item.

### Instrumentation

The combined survey instrument (Appendix A) was comprised of five different subscales and six demographic items. The subscales were availability of fruits and vegetables in the home (AV scale), nutrition knowledge (NK scale), food preparation ability (FP scale), cooking self-efficacy (SE scale), and the Food Frequency Questionnaire (FFQ) for fruit and vegetable intake. Each of these subscales has been tested for validity (Anderson et al., 2002; Marsh et al., 2003; Parmenter & Wardle, 1999; Thompson et al., 2002). The different components of the combined instrument are discussed below. Permission to use the subscales was obtained from the respective

authors of the scales. The FP, NK, and SE scales were originally used in Great Britain, and thus were modified from their original version to be more easily understood by the American population of the current study (e.g. “muesli bars” was changed to “granola bars”).

### *Demographic Items*

Six demographic items were included in the combined scale in order to understand and describe the study sample. The demographic items included race/ethnicity, age, gender, marital status, living situation, and meal plan participation.

### *AV Scale*

The AV scale measured the availability in the home of four types of juice, 17 fruits, and 17 vegetables whether fresh, frozen, dried or canned, in the past seven days (Marsh et al., 2003). The foods included in the questionnaire were determined as those most commonly consumed by using national data from the Continuing Survey of Food Intake by Individuals. In order to test the validity of the AV scale, researchers recruited children in grades four through six in Houston, Texas and their parents to participate. Parents were asked to report on the availability of the listed fruits, juices, and vegetables. After the parents completed the questionnaire, the researchers asked permission to conduct an in-home inventory of the same food items that were included in the questionnaire. The self-report data and observed data were totaled separately and then compared to determine the degree of agreement (Marsh et al.).

The researchers used Cohen’s kappa of agreement and Spearman correlation analysis to determine the validity of the instrument. When fruit, juice, and vegetable scores were combined, the agreement between the self-report data and observation data was 75.9%, with sensitivity of 36.8% and specificity of 39.1%. There was significant ( $p < .05$ ) agreement between self-report and observational data as determined by Cohen’s kappa analysis. Spearman correlations were significant for total fruit availability ( $r = .56, p < .001$ ), total juice availability ( $r = .52, p < .001$ ),



total vegetable availability ( $r = .44, p < .001$ ) and total fruit, juice, and vegetable availability ( $r = .55, p < .001$ ). When individual items were analyzed, there were some non-significant results. Non-significant kappas and nonsignificant correlations were found for six items: bananas, oranges, plums, mashed potatoes, corn, and coleslaw. The authors suggested that the foods that had the least amount of agreement were those that appear to be highly perishable (bananas, mashed potatoes) and thus were more likely to have been consumed before the researchers conducted the observations (Marsh et al., 2003).

The AV scale consists of 38 items; the scale asks “Did you have each of the following foods in your home in the last week?” Participants check either “yes” or “no” to each fruit, juice, or vegetable item listed. Items are coded as yes = 1 (meaning the food was present in the home in the past 7 days), and no = 0 (meaning the food was not present in the home in the past 7 days). Scores were totaled to obtain a total fruit and vegetable score. Higher scores indicated greater availability in the home.

#### *NK Scale*

The NK scale was developed to provide an overall measure of adults’ nutrition knowledge (Parmenter & Wardle, 1999). The scale measures knowledge of dietary recommendations, nutrient content of foods, everyday food choices, and diet-disease relationships. For this study, the everyday food choices section of the survey was omitted to limit the length of the survey, and due to the subjective nature of the questions. To test the validity of the NK scales, nutrition experts created a pilot survey that was then administered to 391 adults in the UK. Based on their feedback, the survey was revised and then administered to 168 college students to test for validity and reliability.

Significant Cronbach alpha measures for the dietary recommendations ( $\alpha = .70, p < .05$ ), nutrient sources ( $\alpha = .95, p < .05$ ), and diet disease relationships ( $\alpha = .94, p < .05$ ) subscales

indicate that the instrument has good internal reliability. To test for construct validity, the researchers compared the results of dietetic students to those of computer students. Since dietetic students scored significantly higher ( $p < .001$ ) than computer students, even after controlling for gender differences between the groups, the researchers stated that the questionnaire meets the criterion for construct validity (Parmenter & Wardle, 1999).

The NK scale comprises 103 questions. Correct responses were scored as one point and incorrect answers were scored as zero points. Scores from the three subscales were added to form one score for the whole scale. A higher score indicated greater nutrition knowledge.

#### *FP Scale*

In order to assess the basic food preparation skills required to prepare familiar dishes, the FP scale asked the participants to correctly identify the major ingredients needed to prepare four common foods (Anderson et al., 2002). Each food item has three to five main ingredients, for a total of 17 items for this section of the scale. Additionally, participants are asked to identify approximate cooking times of common meal items. This portion of the scale consists of five items.

Face validity was determined by consulting both a panel of academic nutrition experts and a group of children ages 8-14 years (Anderson et al., 2002). Pilot testing of the instrument was conducted with 77 children in England. Results of the pilot test dictated minor changes to be made in the instrument (including graphical presentation and phrasing) before the questionnaire was administered to the same children a second time. Correlational analysis was conducted in order to determine test-retest reliability.

Significant correlations ( $r = 0.58, p < .001$ ) were found in test and re-test scores, indicating acceptable, but not good, reliability of the instrument. Significant Cronbach's alpha ( $\alpha = 0.69, p < .001$ ) for the scale indicated that the individual items were correlated with the total

score. Discrimination index analysis indicated that the scale may not have the ability to distinguish between subjects who score high on the test and those who score low, because less than 20% of the participants were able to correctly identify the major ingredients for three of the four foods included in the survey (Anderson et al., 2002). However, the testing was conducted with young children, who may have limited experience with food preparation. The scale may be more reliable with older children or adults who have more practical experience with food preparation.

The total FP scale is 22 items. Each item is scored as one point for correct answers and zero points for incorrect answers. A higher score indicates greater food preparation skill.

#### *SE Scale*

The SE scale was designed to assess participants' perceived ability to prepare common food items (Anderson et al., 2002). Food items on this scale were identical to the food items used in the FP scale. Participants were asked whether they could prepare the food item, and then were given four response choices: "all by myself," "with a little help," "with a lot of help," or "not at all."

Reliability testing for the SE scale was conducted in the same manner as for the KN and FP scales. The test-retest correlations for the SE scale were significant ( $r = 0.38, p < .001$ ), as was the Cronbach's alpha correlation ( $\alpha = .78, p < .001$ ) (Anderson et al., 2002).

The SE scale has nine items, with a maximum score of 27 points. Items were scored as follows: three points for "all by myself," two points for "with a little help," one point for "with a lot of help," and zero points for "not at all." Higher scores indicate greater self-efficacy.

#### *Food Frequency Questionnaire (FFQ)*

The FFQ method of diet recall was originally used in the Harvard Nurses' Health Study (Colditz, 1995). The FFQ used in this study is a modified version of the Nurses' Health Study

FFQ. Modifications were made from the original FFQ to more accurately capture the eating patterns of students at Utah State University (H. Wengreen, personal communication, January 30, 2009). Food frequency questionnaires are considered a reliable method for collecting diet information from groups of people.

The FFQ had 42 items. Each item listed a food and asked the respondent to identify how often they consume that particular food. Response options and the associated score include: “Never or less than one per month (score of zero points),” “one to three times per month (.067 points),” “one per week (.214 points),” “two to four times per week (.5 points),” “five or six times per week (.786 points),” “one time per day (1 point),” “two or three times per day (2.5 points),” “four or five times per day (4.5 points),” “six or more times per day (6.0 points).” The scores from each response were added for a total score indicating number of servings of fruits and vegetables consumed per day. Higher scores indicated greater intake of fruits and vegetables.

#### *Pilot test*

Pilot testing of the combined instrument was conducted prior to the initiation of the study in order to identify and address any problems with the combined instrument. The pilot test utilized a convenience sample of 25 USU students enrolled in Health and Wellness in spring semester of 2009. Class members were asked to complete the questionnaire during class time and the questionnaires were collected immediately. Participants were asked to give written feedback about the survey (Appendix B). It took the participants between 15 and 25 minutes to complete the survey, with the majority completing it in less than 20 minutes. Minor changes to the survey instrument were made following pilot testing, including wording changes to make questions more clear.

Pilot test participants were demographically similar to the study population. Pilot test participants mainly reported their race/ethnicity as White (92%), and 64% of the pilot test sample

were female. Participants ranged in age from 18 to 50 years, with an average age of 22 years. The majority were single (76%), and 88% did not participate in a USU meal plan. While most of the participants lived off-campus with roommates (48%), 16% lived off campus with family, 32% lived on campus, and 1 participant chose “other” for their living situation. Linear regression analysis of all ten predictive variables in relation to fruit and vegetable intake using the pilot study data yielded no statistically significant results.

### Data Collection Procedures

Approval was obtained from the Institutional Review Board (IRB) of USU prior to the beginning of data collection (Appendix C). The combined survey instrument was administered in large USU classes that students from a diverse range of majors and in different stages of their education attend. These classes included Intermediate Writing, Family Finance, and US Institutions. Permission to introduce the survey and invite students to participate immediately following class was obtained from the professors in charge of the respective classes. The questionnaire was administered using traditional paper and pencil format and took approximately 20 minutes for students to complete.

Consistent with IRB guidelines, each participant received a letter of information (Appendix D). Participants who completed the survey after having read the letter of information were presumed to have given informed consent. Participants were informed that they were free to keep the letter of information for future reference. The letter of information contained information about the purpose of the study, the risks and benefits associated with participating, a statement that participation was voluntary and that no penalties resulted from nonparticipation. In addition, the researcher provided contact information for participants who had questions about the research project.

In order to attract participants for the survey, students who completed a questionnaire were entered into a drawing to win one grand prize of \$50 cash or one of five additional prizes valued at \$20 each, including gift cards to local restaurants and stores. A small section of paper providing a place for the participant to write a valid email address was provided at the end of each survey. Participants were asked to remove this portion of the paper and return it in a separate box from the surveys in order to maintain anonymity. Participants were not asked for any identifying information except a valid email address.

The papers with the email addresses were kept until data collection was complete, and then a drawing was held to determine which participants won prizes. Prize winners were emailed that they won a prize. Prizes were left in the HPER main office for pick-up for 2 weeks. Prizes not claimed within 2 weeks of notification were considered forfeited, and another prize winner was selected and notified in the same manner until all prizes were claimed.

Once the completed questionnaires were collected, the data were coded as described in the “Instrumentation” section. Data were entered into SPSS statistical software in preparation for data analysis.

### Data Analysis

Statistical data analysis was used to address the research questions introduced in Chapter one. The demographic data collected were categorical, except age, which was continuous; all other data collected in the study were continuous. Originally it was determined that Poisson multiple regression would be used to analyze the data; Poisson regression is used when the dependent variable data may be skewed (if there are many students who eat very little or no fruits and vegetables). However, Poisson regression analysis requires that the dependent variable be in integer form. It was determined that to transform the data collected in this study to make the dependent variable (fruit and vegetable intake) into integer form would result in a loss of detail

deemed unacceptable. Upon examining the data from the completed surveys, it was determined that the dependent variable (fruit and vegetable intake) could be transformed in order to correct for the skew and allow the data to be analyzed using linear multiple regression. The assumption for data skewness is that if the data are skewed greater than  $+2$  or  $-2$ , then the data should not be analyzed without transformation (Cohen, 1988). The non-transformed data's skewness was 2.65 ( $SE = .169$ ). The data were transformed using SPSS statistical software under supervision and in counsel with a professional statistician (J. Fargo, personal communication, March 25, 2009). The data were transformed by taking the natural log of the variable. This type of data transformation is one of the simplest ways to transform data (Cohen), and was deemed to be the appropriate way to transform the data because of the way the data were skewed (J. Fargo, personal communication, March 25, 2009). Following the transformation of the data, it was determined that the data met criteria for linear multiple regression, as the skewness for the transformed data was well within the acceptable level at  $-.439$  ( $SE = .169$ ).

The researcher calculated the Cronbach's alpha on each subscale of the survey in order to examine the reliability of the scales with the current population. Table 1 shows how the research questions were related to the survey instrument and how the data were analyzed to address each question. Items 167-209 represented the FFQ and were used to estimate fruit and vegetable intake.

### Summary

This study examined the relationships between SCT constructs and fruit and vegetable intake in college students. The methodology and analysis that were used to complete the survey were discussed in this chapter, including the research design, sample and population, instrumentation and data collection, and statistical analysis.

Table 1

<i>Research Questions and Statistical Analysis Methods</i>		
Research question	Item no.	Statistical method
Is availability of fruits and vegetables in the home predictive of college students' fruit and vegetable intake?	7-44	Multiple regression
Is nutrition knowledge predictive of college students' fruit and vegetable intake?	45-148	Multiple regression
Is food preparation ability predictive of college students' fruit and vegetable intake?	149-157	Multiple regression
Is cooking self-efficacy predictive of college students' fruit and vegetable intake?	158-166	Multiple regression
Are the demographic factors of race/ethnicity, age, gender, marital status, living situation, or participation in a campus meal plan predictive of college students' fruit and vegetable intake?	1-6	Multiple regression



## CHAPTER 4

### RESULTS

The current study was conducted to determine whether Social Cognitive Theory factors of home availability of fruits and vegetables, nutrition knowledge, food preparation ability, cooking self-efficacy and the demographics factors of race/ethnicity, age, gender, marital status, living situation, and meal plan participation were predictive of college students' fruit and vegetable consumption. This chapter discusses the results of the five research questions posed in chapters one and three.

#### Sample Demographics

Demographic data describing the race ethnicity, gender, marital status, and meal plan participation are presented in Table 2 below. Participants ranged in age from 18 to 62 years, with a mean age of 21.42 years, and 92.3% of the participants reported White as their race/ethnicity.

#### Research Question 1:

Is availability of fruits and vegetables in the home predictive of college students' fruit and vegetable intake?

To answer this question, participants completed the AV Scale. Participants were asked to report whether certain fruits, vegetables, and juices were available in their home during the past week, whether fresh, canned, frozen, or dried. Participant responses were coded as described in Chapter 3, and a total score was obtained for each participant. Higher scores indicated more fruits and vegetables available in the home. Totaled scores from the FFQ, representing daily servings of fruits and vegetables consumed, were used as the dependent variable in the regression model.

Table 2

*Sample Demographics*

Demographic	Group	Frequency	Percentage
Race/Ethnicity	American Indian	1	0.5
	Asian	5	2.4
	Black	2	1.0
	Native Hawaiian/Pacific Islander	0	0
	White	191	92.3
	Hispanic	8	3.9
Gender	Male	78	37.7
	Female	129	62.3
Marital Status	Single, never married	165	79.7
	Married	42	20.3
Meal Plan	Yes	21	10.1
Participation	No	186	89.9
Living Situation	Off campus apartment, with roommates	76	36.7
	Off campus, with family, spouse, or alone	56	27.1
	On campus apartment, fraternity/sorority house	75	36.2

*Note.* Total sample size  $N = 207$

Evaluation of the assumptions of the analysis revealed that the dependent variable data needed to be transformed as described in Chapter 3. Standard linear multiple regression analysis was performed using SPSS 17 statistical software. Results of the full regression analysis model are displayed in Table 3. The regression model demonstrated that availability of fruits and vegetables in the home was a significant predictor of fruit and vegetable consumption in USU college students,  $t(206) = 7.050, p = .000$ .

Research Question 2:  
Is nutrition knowledge predictive of college students'  
fruit and vegetable intake?

Data from the NK Scale were used to answer research question two. Participants were asked questions about current dietary recommendations, nutrient content of foods, and diet-disease relationships. Participant responses were coded as described in Chapter 3, and a total score was obtained for each participant. Higher scores indicated greater nutrition knowledge, and the total scores were analyzed with totaled scores from the FFQ (transformed as described in Chapter 3) as the dependent variable in the regression model. Standard linear multiple regression analysis was performed using SPSS 17 statistical software. The results of the analysis appear in Table 3 below. Nutrition knowledge was not a significant predictor of the amount of fruits and vegetables USU college students eat,  $t(206) = 1.030$ ,  $p = .304$ . In other words, having more knowledge of nutrition principles did not predict eating more fruits and vegetables.

Table 3

*Summary of Simultaneous Regression Analysis for Availability, Knowledge, Food Preparation, and Self-Efficacy*

Variable	<i>N</i>	<i>B</i>	<i>SE B</i>	<i>t</i> -value	<i>p</i> -value
Availability of fruits and vegetables in the home	207	.056	.008	7.050	.000*
Nutrition knowledge	207	.006	.005	1.030	.304
Food preparation ability	207	-.010	.015	-.646	.519
Cooking self-efficacy	207	.027	.011	2.471	.014*

\*  $p < .05$ .

Research Question 3:  
Is food preparation ability predictive of college students'  
fruit and vegetable intake?

Research question three was addressed through data collected on the FP scale portion of the survey. Participants were asked to name key ingredients in common food dishes and to indicate whether certain food items took less than, or longer than 15 minutes to prepare. Participant responses were coded as described in Chapter 3, and a total score was obtained for each participant. Higher scores indicated greater food preparation ability. These data were entered into the regression model with totaled scores from the FFQ (transformed as described in Chapter 3) as the dependent variable. Standard linear multiple regression analysis was performed using SPSS 17 statistical software. The results of the analysis appear in Table 3 above. In this study, food preparation ability was not found to be a significant predictor of USU college students' fruit and vegetable intake,  $t(206) = -0.646$ ,  $p = .519$ , meaning that those persons who had greater food preparation ability were no more likely to eat fruits and vegetables than those with lesser food preparation ability.

Research Question 4:  
Is cooking self-efficacy predictive of college students'  
fruit and vegetable intake?

To answer this question, totaled scores from the SE scale (coded as described in Chapter 3) were entered into multiple regression model with transformed FFQ data as the dependent variable. Results of the standard linear regression model are presented in Table 3. Cooking self-efficacy was found to be a significant predictor of the amount of fruits and vegetables that USU college students consume,  $t(206) = 2.471$ ,  $p = .014$ . Those who had greater cooking self-efficacy were more likely to consume significantly more fruits and vegetables than those with lower cooking self-efficacy.

Research Question 5:

Are the demographic factors of race/ethnicity, age, gender, marital status, living situation, or participation in a campus meal plan predictive of college students' fruit and vegetable intake?

Demographic data were collected as questions one through six on the survey. To compare groups in a multiple regression model, there should be at least ten percent of the sample in each categorical group (Cohen, 1988). Since 92.3% of the sample in this study reported their race/ethnicity as "White," it would violate the assumptions of the analysis to compare the different race/ethnicity categories using this data. Therefore, race/ethnicity was not entered into the regression model for analysis.

Two participants selected "Fraternity or Sorority house," and one participant selected "Other" on question five (living situation) of the survey. Since these categories could not be included in the regression model without violating the assumptions of the analysis, as described above, these three participants' scores were re-coded. "Fraternity or Sorority house" was re-coded as "On-campus apartment," and "Other" was re-coded as "Off-campus apartment or house, with family or spouse" (the participant had made a note on the survey that they lived alone in their own home). The re-coded choices were deemed by the researcher to be the most similar to the participants' original answers. Therefore, only three choices for living situation were included in the regression model: "Off-campus apartment or house, with roommates," "Off-campus apartment, with family or spouse," and "On-campus apartment."

The resulting data for age, gender, marital status, living situation, and meal plan participation were entered into the regression model with transformed FFQ data as the dependent variable. Standard linear multiple regression analysis was performed using SPSS 17 statistical software. The results are presented in Table 4. Age, gender, marital status and living situation

Table 4

*Summary of Simultaneous Regression Analysis for Age, Gender, Marital Status, Living Situation, and Meal Plan Participation*

Variable	N	Estimate	SE	t-value	p-value
Age	207	.008	.010	.889	.375
Gender	207	-.128	.104	-1.239	.217
Marital Status	207	-.023	.124	-.184	.854
Living Situation	207	-.064	.055	-1.157	.249
Meal Plan Participation	207	-.343	.159	-2.155	.032*

\*  $p < .05$ .

were not found to be significant predictors,  $t(206) = 0.889$ ,  $p = .375$ ;  $t(206) = -1.239$ ,  $p = .217$ ;  $t(206) = -0.184$ ,  $p = .854$ ;  $t(206) = -1.157$ ,  $p = .249$ , respectively.

Of the demographic factors studied, only meal plan participation was found to be a significant predictor of fruit and vegetable intake in this population,  $t(206) = -2.155$ ,  $p = .032$ . Participants who reported participating in a meal plan consumed more fruits and vegetables than those not participating in a meal plan. The negative t-value was a result of the way this variable was coded. Responses to the question “Do you participate in a USU meal plan?” were coded as “yes” equal to one point and “no” equal to two points. The negative t-value indicates that an increased value for meal plan participation was associated with a decrease in fruit and vegetable intake. In other words, participants who selected “no” to the question “Do you participate in a USU meal plan?” consumed less fruits and vegetables than those who selected “yes” in response to the same question.

It is notable that the complete model, with all nine predictor factors, had an  $R^2$  value of .312, which is a medium effect size according to the Cohen’s “rules of thumb” for  $R^2$  (Cohen, 1988).

This indicates that approximately 31% of the variability in fruit and vegetable intake seen in this population can be explained by the variables in the regression model.

### Scale Reliability

In order to determine whether the scales used in the survey were reliable with the current population, Cronbach's alpha analysis was performed on each of the subscales. The results are presented in Table 5. In general, scale reliability scores over 0.7 indicate that the scale is reliably measuring the construct it is designed to measure; however, scores below 0.7 indicate that results drawn from the scale should be interpreted with caution (Cohen, 1988). Four of the five scales used in this study were shown to have good reliability in this population, as indicated by Cronbach's alpha scores over 0.7. The reliability score of the FP Scale, well below the acceptable level at 0.376, indicates that results related to this scale should be interpreted with caution.

Table 5

<i>Scale Reliability Measures</i>		
Scale	# of Items	Cronbach's alpha
Availability (AV)	37	.812
Nutrition Knowledge (NK)	104	.798
Food Preparation (FP)	9	.376
Self-Efficacy (SE)	9	.816
Food Frequency Questionnaire (FFQ)	43	.868

This section described the study results for each of the research questions. The next section will discuss the results in relation to the findings of other studies with conclusions. The researcher will also make suggestions for the use of these findings and for future research in this area.



## CHAPTER 5

### DISCUSSION

The current study was conducted to add to existing research about how SCT factors and demographic factors influence fruit and vegetable consumption by examining the factors in a population that has not been well-researched in this area. In this chapter, results of the current study are compared to previous studies and analyzed for better understanding of how SCT and demographic factors influence the amount of fruits and vegetables that college students eat. The results of the current study compared to past research are presented in Table 6 below.

#### Conclusions

*Question 1: Is availability of fruits and vegetables in the home predictive of college students' fruit and vegetable intake?*

The results of this study indicate that the amount of fruits and vegetables that college students eat is influenced by the amount of fruits and vegetables they have in their home. In other words, having more fruits and vegetables in the home was a positive significant predictor of fruit and vegetable consumption.

Very little past research disagrees with the findings of the current study. Martens et al. (2005) did not find a relationship between availability and fruit and vegetable intake in the population of Dutch adolescents that they studied. Befort et al. (2006) found that the influence of availability varied between groups based on gender and ethnicity, with some groups having no associations at all while other groups did have a significant association between availability and intake.

However, there is substantial literature that has reported a significant relationship between availability and consumption of fruits and vegetables in children (Hearn et al., 1998;

Table 6

*Results of Current Study Compared to Previous Research*

Research question	Study results	Previous research	Previous research
		agreeing with current study results	disagreeing with current study results
Is availability of fruits and vegetables in the home predictive of college students' fruit and vegetable intake?	Availability was a significant predictor.	Bere & Klepp, 2004 Brug et al., 2008 Cullen et al., 2003 Granner, 2004 Harris & Murray, 1997 Hearn et al., 1998 Hinton, 1998 Jago et al., 2006 Kratt et al., 2000 Michaud et al., 2007 Neumark-Sztainer et al., 2003 Young et al., 2004	Martens et al., 2005
Is nutrition knowledge predictive of college students' fruit and vegetable intake?	Nutrition knowledge was not a significant predictor.	Blanchette & Brug, 2005 Kolodinsky et al., 2007	Brug et al., 2008 Hinton, 1998 Reynolds et al., 2002 Wardle et al., 2000 Watters et al., 2007 Wei et al., 2007

Research question	Study results	Previous research	Previous research
		agreeing with current study results	disagreeing with current study results
Is food preparation ability predictive of college students' fruit and vegetable intake?	Food preparation ability was not a significant predictor.	Larson, Perry, et al., 2006	Bere & Klepp, 2004 Holmes et al., 2008 Hughes et al., 2004 Larson, Story, et al., 2006
Is cooking self-efficacy predictive of college students' fruit and vegetable intake?	Cooking self-efficacy was a significant predictor.	Anderson et al., 2007 Bere & Klepp, 2005 Brug et al., 2008 Hagler et al., 2007 Lawrence et al., 2000 Omidvar et al., 2003 Van Duyn et al., 2001 Watters et al., 2007	Hinton, 1998 Larson, Perry, et al., 2006 Martens et al., 2005

Research question	Study results	Previous research	Previous research
		agreeing with current study results	disagreeing with current study results
Are the demographic factors of race/ethnicity, age, gender, marital status, living situation, or participation in a campus meal plan predictive of college students' fruit and vegetable intake?	Race/ethnicity was not evaluated. Age, gender, marital status, and living situation were not significant predictors. Meal plan participation was a significant predictor.	Dinger, 1999 Harris & Murray, 1997 Racette et al., 2008	Brug et al., 2008 DeBate et al., 2001 Guenther et al., 2006 Kasperek et al., 2008

Kratt et al., 2000; Hinton, 1998;) and young adolescents (Bere & Klepp, 2004; Brug et al., 2008; Granner, 2004; Neumark-Sztainer et al., 2003; Young et al., 2004), but only one other study has examined this relationship in college students. The study conducted by Harris and Murray (1997) demonstrated that availability was a significant predictor in college students and was in fact the most significant predictor. The current study supports these previous findings. Availability was the strongest significant predictor of fruit and vegetable intake in this population.

Availability of fruits and vegetables in the home may influence a person's fruit and vegetable intake in two ways. Having the fruits and vegetables available makes it easier and more convenient for a person to choose them. This could arguably be the most important way that home availability can influence food choices. In addition, having fruits and vegetables in the home may act as a prompt or reminder to consume them on a regular basis.

*Question 2: Is nutrition knowledge predictive of college students' fruit and vegetable intake?*

Nutrition knowledge was not a significant predictor of fruit and vegetable intake in the current study. Although there have been studies that have found a significant association between nutrition knowledge and fruit and vegetable consumption (Brug et al., 2008; Hinton, 1998; Reynolds et al., 2002; Wardle et al., 2000; Watters et al., 2007; Wei et al., 2007), others have found no association (Kolodinsky et al., 2007), or conflicting results (Blanchette & Burg, 2005; Worsley, 2002). Kolodinsky et al. found that while nutrition knowledge predicted fruit intake in college students, there was no significant association with vegetable intake. Worsley concluded, after conducting a literature review on the association between nutrition knowledge and fruit and vegetable consumption, that knowledge is necessary, but not sufficient to change behavior. The SCT suggests that skills are needed, in addition to knowledge, in order to modify behavior.

Although the current study made use of a validated instrument that was shown to have good reliability in the study sample, the instrument lacked a section designed to assess whether participants could choose foods that met dietary and nutrition recommendations. Therefore, the current study did not assess whether participants' nutrition knowledge was practical or strictly theoretical. A measurement of practical nutrition knowledge may have yielded a stronger association between knowledge and behavior.

Although no attempts were made to compare this study population to any other populations, it is possible that this population, all college students, could have had greater

nutrition knowledge than other populations. This possible bias towards greater nutrition knowledge may have diminished any associations between nutrition knowledge and fruit and vegetable consumption that may have existed in this population. Populations that include those with less education may provide a better picture of the relationship between nutrition knowledge and fruit and vegetable intake, if such a relationship exists.

Furthermore, Worsely (2002) noted after conducting a literature review about nutrition knowledge's impact on fruit and vegetable intake that the relationship may be very small. The sample size utilized in this population was deemed to have enough power to detect moderate effect sizes, but was probably insufficient to detect small effect sizes. Therefore, even if there was a small relationship between knowledge and fruit and vegetable consumption in this population, there may not have been enough statistical power to detect the relationship.

*Question 3: Is food preparation ability predictive of college students' fruit and vegetable intake?*

The current study did not find a significant association between food preparation ability and fruit and vegetable consumption, contrary to previous research suggesting such a relationship in elderly men (Holmes et al., 2008; Hughes et al., 2004), young adults (Larson, Story, et al., 2006) and adolescents (Bere & Klepp, 2004). One other study utilizing a sample of young adults (Larson, Perry, et al., 2006) found no association between food preparation and fruit and vegetable intake, indicating that although this association may exist in other populations, the association may not exist or may be weak in young adults and college students.

Larson, Perry, et al. (2006) found that the majority of young adults in their study felt they lacked sufficient time to prepare foods. It is plausible that while many college students may possess the ability to prepare foods, they may not have the time to put those skills to use. If so, then greater food preparation ability would not necessarily correlate with any dietary measurements.

The results of the current study must be interpreted with caution, as the scale used to assess food preparation ability was shown to have unacceptable reliability with the study sample. The scale used in this study asked participants to list ingredients in common foods and to assess the time required to prepare familiar dishes. These measurements may not adequately capture true food preparation ability. Further research using tools superior in measuring food preparation ability would answer this research question more satisfactorily than the current study.

*Question 4: Is cooking self-efficacy predictive of college students' fruit and vegetable intake?*

The results of the current study indicate that cooking self-efficacy has a significant positive effect on the amount of fruits and vegetables eaten by college students. Prior to this study, research on cooking self-efficacy was lacking. Other studies have examined self-efficacy related to healthy eating in relation to fruit and vegetable intake and have found mixed results (see, for example, Brug et al., 2008; Hinton, 1998; Gallaway et al., 2007; Martens et al., 2005; Omidvar et al., 2003; Zabinski et al., 2006).

Only two studies have examined cooking self-efficacy specifically in relation to fruit and vegetable consumption, and these studies also found differing results. Lawrence et al. (2000) found a significant relationship between these variables in a sample of women in Great Britain, while Larson, Perry, et al. (2006) found no relationship between the variables in a group of young adults in the United States. The current study adds clarification to the influence that cooking self-efficacy can have on fruit and vegetable consumption, and contributes to the literature on self-efficacy.

High cooking self-efficacy may also be an indicator of a greater sense of self-efficacy related to healthy eating. Those who have a high cooking self-efficacy may be more confident in their ability to accomplish many other tasks related to healthy eating, and several studies have suggested that self-efficacy related to healthy eating could have a positive effect on fruit and

vegetable consumption in children (Brug et al., 2008), adolescents (Bere & Klepp, 2005; Omidvar et al., 2003), and adults (Anderson et al., 2007; Hagler et al., 2007; Van Duyn et al., 2001).

Another explanation is that cooking self-efficacy may be a more accurate indicator of cooking skills or ability than food preparation ability as measured through survey instruments. It is difficult, if not impossible, to measure such a skill through a survey. However, having a greater sense of cooking self-efficacy could indicate more experience and comfort in preparing foods. This greater experience with food preparation could in turn result in less reliance on commercially-prepared foods that contain little, if any, fruits and vegetables (Caraher & Lang, 1999). Stead et al. (2004) suggested that having cooking skills may lessen one barrier that many people face in heeding dietary recommendations: the ability to prepare foods that meet those recommendations while still being appealing.

*Question 5: Are the demographic factors of race/ethnicity, age, gender, marital status, living situation, or participation in a campus meal plan predictive of college students' fruit and vegetable intake?*

Race/ethnicity was not examined in this study due to the lack of racial and ethnic diversity in the study population, as described in Chapter 4. None of the demographic factors of age, gender, marital status, and living situation were found to have a statistically significant influence on fruit and vegetable intake in this study. Although other studies have found differences in fruits and vegetables eaten based on these characteristics (Brug et al., 2008; DeBate et al., 2001; Guenther et al., 2006; Kasparek et al., 2008), other studies have found no differences based on these demographic factors (Dinger, 1999; Harris & Murray, 1997; Racette et al., 2008).

The sample utilized in this study consisted of persons within a limited range of ages. The majority of participants (93%) were between the ages of 18 and 24 years of age, with a mean age of 21.42 years. There were a few participants ( $n = \text{four}$ ) over the age of 30 years, but they did not



contribute enough statistical power in this study to examine a very wide range of ages. Studies utilizing a sample that represents a wider range in ages would be more effective at measuring a difference in fruit and vegetable intake according to age, if such a difference exists.

Some studies have found differences in the amount of fruits and vegetables eaten between males and females (DeBate et al., 2001; Guenther et al., 2006), and other studies have failed to find such an association (Dinger, 1999; Racette et al., 2008). Males typically have greater caloric needs than females, and therefore need to consume more food overall; it is possible that males eat more fruits and vegetables than females, but the percentage of total calories provided by fruits and vegetables between males and females is similar. The current study indicates that there is no difference between genders' eating patterns related to fruits and vegetables in this population.

While it was theorized that marital status could influence fruit and vegetable intake, there was no significant difference based on marital status in this sample. Students, whether married or single, often face high demands and have limited time and money to spend on food. Previous research has found that lack of time can have a profound effect on college students' eating habits (Larson, Perry et al., 2006), and this is likely an effect that persists even in marriage. Studies utilizing a sample of non-students may find a relationship between marital status and fruit and vegetable consumption, but such a relationship was not apparent in this study.

Living situation was not significantly associated with fruit and vegetable consumption in this study. This agrees with the findings of Dinger (1999), who also found no difference in fruit and vegetable intake based on living situation. However, Harris and Murray (1997) found a difference in fruit and vegetable consumption between students who lived at fraternity/sorority houses and those living in on-campus dormitories. The current study did not have enough participants living in fraternity/sorority houses to assess the same differences as Harris and Murray's study. The current study did seek to determine if there was a difference between

students living on-campus, off-campus with roommates, or off-campus with family or spouse. However, on-campus and off-campus housing at Utah State University is not appreciably different in terms of geography, room layout, space, and resources available. This similarity of living situation likely contributed to the lack of any significance in fruit and vegetable consumption according to living situation in this study.

Meal plan participation was positively associated with fruit and vegetable intake in this population. This supports the findings of Harris and Murray (1997), which indicated that students participating in a full meal plan had greater fruit and vegetable intake than those with a partial plan.

Meal plan participation may facilitate consumption of fruits and vegetables in many ways. Most importantly, participation may influence intake by making fruits and vegetables readily available and accessible to those who participate in the plan. In addition, those participating in a meal plan do not have to participate in shopping for and preparing the foods that they consume, so eating fruits and vegetables may be more convenient for those with a meal plan than those who shop for and prepare their own foods. The fruits and vegetables offered through a meal plan may also be more esthetically appealing and prepared in a more appealing way than those prepared at home (e.g. a mixed dish of vegetables versus vegetables heated from a can). While many students may feel that buying fruits and vegetables is expensive, meal plan participants may not think about the expense of the foods they consume if they have already paid a set amount. Thus, meal plan participation may eliminate or greatly reduce the major barriers to eating fruits and vegetables that many college students face: lack of time and money.

### Implications for Health Education

Many professional health organizations have recognized the importance of fruit and vegetable intake as a preventative health measure, and have consequently put forth

recommendations encouraging Americans to consume more fruits and vegetables (AHA, 2007; ACS, 2006; USDHHS, 2005a). College students are one population that is especially likely to fall short of these recommended levels of fruit and vegetable intake (DeBate, et al. 2001; Dinger, 1999; Haberman & Luffey, 1998; Li Hui, et al. 2008). Furthermore, college students may be an optimal population for health education efforts aimed at increasing fruit and vegetable intake, as most are living on their own for the first time and are developing health practices that they will carry with them throughout their lives.

The current study provides data about factors that could positively impact college students' fruit and vegetable consumption, which can be used in health education efforts targeting this population. It is noteworthy that all of the factors significantly related to fruit and vegetable intake in this study are modifiable factors. Although this study only examined the predictive association of these factors in relation to fruit and vegetable intake, these factors could be targeted in health education efforts aimed at behavior change.

Home availability of fruits and vegetables is one factor that health educators could easily focus on in their efforts to improve college students' fruit and vegetable intake. Health professionals who work with college students should evaluate and strive to minimize the barriers that get in the way of college students having fruits and vegetables available in their homes. Since availability has been shown to be such a relevant factor to fruit and vegetable intake in a wide variety of populations (Bere & Klepp, 2004; Brug et al., 2008; Granner, 2004; Hearn et al., 1998; Kratt et al., 2000; Hinton, 1998; Neumark-Sztainer et al., 2003; Young et al., 2004) efforts to improve home availability may prove to be beneficial in many health education settings. Improving availability could be achieved through encouraging the sale of fruits and vegetables at places that college students generally shop for groceries or buy meals (e.g. the Hub), creating a price break or discount on fruits and vegetables for college students, and encouraging the use of fruits and vegetables as prizes for programs/activities that give away free food (e.g. Welcome

Week or A-Day). In addition, the USU organic farms and other community-supported agriculture (CSA) projects could provide a simple way for USU students to purchase fresh, locally-grown produce. These programs may also offer a discount on produce in exchange for labor from the student, allowing students to be a part of growing their own food.

Although many college students will continue to opt out of meal plan participation, health educators can seek to extend the benefits of meal plan participation to non-participants. If the availability, accessibility, and convenience of fruits and vegetables can positively influence meal plan participants' fruit and vegetable consumption, then health professionals should seek to make fruits and vegetables more available, accessible, and convenient for college students. The suggestions for improving availability of fruits and vegetables above could be applied, in addition to encouraging the offering of fruit and vegetable dishes at places that college students frequently eat. If future research suggests that there are other ways that meal plan participation improves fruit and vegetable consumption, then those factors can be targeted in health promotion programs.

Even though this study did not find an association between nutrition knowledge and fruit and vegetable intake, it may still be important for health educators to teach college students about nutrition. Behavioral capability, one construct of SCT, suggests that people need both knowledge and skills to achieve behavior change. If health education efforts focus solely on improving skills without increasing knowledge, desired results may not be achieved. However, having both the nutrition knowledge and the skills needed to implement that knowledge may result in substantial increases in fruit and vegetable intake. As the literature suggests knowledge is likely necessary, although not sufficient, to change behavior (Worsley, 2002).

The current study did not find that food preparation ability influenced fruit and vegetable consumption, but cooking self-efficacy was a positive significant predictor of fruit and vegetable intake. This indicates that efforts to improve college students' confidence in their cooking skills could result in higher intakes of fruits and vegetables. Health education efforts aimed at

increasing confidence and comfort with food preparation may have a more significant impact than those that actually teach cooking skills. Interventions that allow students to have positive experiences with food preparation (e.g. the successful preparation of a simple but tasty snack) or that help them become more comfortable in food preparation would likely have a positive effect on students' cooking self-efficacy.

Lastly, the results of this study do not indicate that certain demographic groups are at a higher risk of not meeting recommended levels of fruit and vegetable intake. These results indicate that although consideration should be taken in marketing health education programs to different demographic groups, these programs should target all college students regardless of age, gender, marital status, or living situation.

#### Future Research

The current study utilized a self-report survey, which is a research design known to have flaws. These include, but are not limited to, recall bias, social desirability, and under- and over-reporting of behavior. In addition, the current study used a convenience sample that may not have been typical of the population it represented, although care was taken to target a wide variety of students. Regardless, the study sample was somewhat demographically homogeneous. Obtaining data through a cross-sectional design allowed for data collection in a short period of time, but limited the sample to students who were attending USU on-campus in spring semester, 2009. Sampling techniques that collect data from a more heterogeneous sample of college students would likely produce more accurate results. Further research in this area should seek to minimize the flaws that were inherent in this type of study. However, this study did contribute to the literature by providing data on a little-studied population.

Research related to food preparation ability may become increasingly interesting to researchers in the future, as it has been promising in some populations (Bere & Klepp, 2004;

Holmes et al., 2008; Hughes et al., 2004; Larson, Story, et al., 2006). However, as this study demonstrates, research in this area will be difficult, if not impossible, if instruments to measure food preparation ability are not available. The development of a simple instrument that is valid and reliable is needed before this type of research can progress appreciably.

This study provides evidence that meal plan participation can have a positive impact on college students' fruit and vegetable intake, but does not provide further information. Future research should seek to determine why and how meal plan participation influences fruit and vegetable consumption, so that the benefits of meal plan participation can be extended to non-participants.

Finally, while this study showed that neither nutrition knowledge nor food preparation ability was predictive of fruit and vegetable consumption, the construct of behavioral capability should be researched further. Specifically, though the individual factors (knowledge and skill) were not predictive in this study, research should determine whether having both knowledge and skill can positively influence fruit and vegetable intake more than either knowledge or skill alone.

This chapter compared the results of the current study to the results of previous studies and discussed how SCT and demographic factors influence the amount of fruits and vegetables that college students eat. Recommendations for future research in this area were also presented in this chapter.

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## APPENDIXES

## Appendix A. Survey Instrument

☐ I am at least 18 years old

### Demographic Information

*For each question, please select the answer that best describes you.*

1. What is your race/ethnicity?
  - ☐ American Indian
  - ☐ Asian
  - ☐ Black
  - ☐ Native Hawaiian or Other Pacific Islander
  - ☐ White
  - ☐ Hispanic
2. What is your age? \_\_\_\_\_
3. What is your gender?
  - ☐ Male
  - ☐ Female
4. What is your current marital status?
  - ☐ Single, never married
  - ☐ Married
  - ☐ Divorced
  - ☐ Separated
  - ☐ Widowed
5. Do you live in:
  - ☐ Off-campus apartment or house, with roommates
  - ☐ Off-campus apartment or house, with spouse or family
  - ☐ On-campus apartment or dormitory
  - ☐ Fraternity or Sorority house
  - ☐ Other
6. Do you participate in a USU meal plan program?
  - ☐ Yes
  - ☐ No

### Home Availability of Fruits and Vegetables

*Did you have each of the following foods in your home in the last week, whether fresh, canned, frozen, or dried? Please check the "YES" or "NO" box for each food.*

7	100% Orange Juice	Yes <input type="checkbox"/>	No <input type="checkbox"/>
8	100% Apple Juice	Yes <input type="checkbox"/>	No <input type="checkbox"/>
9	100% Grape Juice	Yes <input type="checkbox"/>	No <input type="checkbox"/>
10	Other 100% Juice	Yes <input type="checkbox"/>	No <input type="checkbox"/>
11	Bananas	Yes <input type="checkbox"/>	No <input type="checkbox"/>
12	Apples	Yes <input type="checkbox"/>	No <input type="checkbox"/>
13	Cantaloupe or other melon	Yes <input type="checkbox"/>	No <input type="checkbox"/>
14	Grapes	Yes <input type="checkbox"/>	No <input type="checkbox"/>
15	Raisins	Yes <input type="checkbox"/>	No <input type="checkbox"/>
16	Other dried fruit	Yes <input type="checkbox"/>	No <input type="checkbox"/>



*Continued from previous page:*  
*Did you have each of the following*  
*foods in your home in the last week?*

17	Plums	Yes <input type="checkbox"/>	No <input type="checkbox"/>
18	Kiwi	Yes <input type="checkbox"/>	No <input type="checkbox"/>
19	Strawberries	Yes <input type="checkbox"/>	No <input type="checkbox"/>
20	Pineapple	Yes <input type="checkbox"/>	No <input type="checkbox"/>
21	Grapefruit	Yes <input type="checkbox"/>	No <input type="checkbox"/>
22	Fruit salad or fruit cocktail	Yes <input type="checkbox"/>	No <input type="checkbox"/>
23	Applesauce	Yes <input type="checkbox"/>	No <input type="checkbox"/>
24	Watermelon	Yes <input type="checkbox"/>	No <input type="checkbox"/>
25	Oranges	Yes <input type="checkbox"/>	No <input type="checkbox"/>
26	Pears	Yes <input type="checkbox"/>	No <input type="checkbox"/>
27	Peaches	Yes <input type="checkbox"/>	No <input type="checkbox"/>
28	Carrots	Yes <input type="checkbox"/>	No <input type="checkbox"/>
29	Celery	Yes <input type="checkbox"/>	No <input type="checkbox"/>
30	Greens (spinach, collard, turnip, kale)	Yes <input type="checkbox"/>	No <input type="checkbox"/>
31	French fried potatoes	Yes <input type="checkbox"/>	No <input type="checkbox"/>
32	Potato salad	Yes <input type="checkbox"/>	No <input type="checkbox"/>
33	Other potatoes	Yes <input type="checkbox"/>	No <input type="checkbox"/>
34	Corn	Yes <input type="checkbox"/>	No <input type="checkbox"/>
35	Green peas	Yes <input type="checkbox"/>	No <input type="checkbox"/>
36	Tomatoes	Yes <input type="checkbox"/>	No <input type="checkbox"/>
37	Broccoli	Yes <input type="checkbox"/>	No <input type="checkbox"/>
38	Lettuce	Yes <input type="checkbox"/>	No <input type="checkbox"/>
39	Green Beans	Yes <input type="checkbox"/>	No <input type="checkbox"/>
40	Coleslaw	Yes <input type="checkbox"/>	No <input type="checkbox"/>
41	Cooked beans (pinto, black or kidney, pork and beans, etc.)	Yes <input type="checkbox"/>	No <input type="checkbox"/>
42	Sweet potatoes	Yes <input type="checkbox"/>	No <input type="checkbox"/>
43	Cabbage	Yes <input type="checkbox"/>	No <input type="checkbox"/>
44	Okra	Yes <input type="checkbox"/>	No <input type="checkbox"/>

### Nutrition Knowledge

*Please read each question carefully and, based on your knowledge, select the best answer. Please do not use outside sources to help you; we want to know what you know on your own. **Please only check one answer per question.***

Do you think health experts recommend that people should be eating more, the same amount, or less of these foods?

	More	Same	Less	Not sure
45. Vegetables	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
46. Sugary foods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
47. Meat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
48. Starchy foods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
49. Fatty foods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
50. High-fiber foods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
51. Fruit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
52. Salty foods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

53. How many servings of fruit and vegetables combined do you think experts are advising people to eat each day (For example, one serving could be an apple or a handful of baby carrots)? \_\_\_\_\_

54. Which fat do experts say is the most important for people to cut down on?

- ☐ Monounsaturated fat
- ☐ Polyunsaturated fat
- ☐ Saturated fat
- ☐ Not sure

55. What version of dairy foods do experts say people should eat?

- ☐ Whole/ full fat
- ☐ Reduced or low fat
- ☐ Mixture of full fat and low fat
- ☐ Neither, dairy foods should be cut out
- ☐ Not sure

Do you think these foods are high or low in *added* sugar?

	High	Low	Not Sure
56. Bananas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
57. Plain, unflavored yogurt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
58. Ice cream	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
59. Winter squash (like banana or acorn squash)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
60. Tomato ketchup	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
61. Canned fruit in its own juice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do you think these are high or low in fat?

	High	Low	Not sure
62. Pasta (without sauce)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
63. Low fat margarine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
64. Baked beans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
65. Sliced lean turkey breast	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
66. Honey	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
67. Fried chicken	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
68. Nuts (peanuts, pistachios, etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
69. Bread	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
70. Regular cottage cheese	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
71. Regular margarine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do you think experts put these in the “grains” food group?

	Yes	No	Not sure
72. Cheese	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
73. Pasta	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
74. Butter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
75. Nuts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
76. Rice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
77. Cereal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do you think these are high or low in salt?

	High	Low	Not sure
78. Sausage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
79. Pasta, without sauce	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
80. Canned green beans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
81. Lean ground beef	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
82. Frozen vegetables	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
83. Cheese	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do you think these are high or low in protein?

	High	Low	Not sure
84. Chicken	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
85. Cheese	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
86. Fruit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
87. Baked beans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
88. Butter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
89. Cream	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do you think these are high or low in fiber?

	High	Low	Not sure
90. Cornflakes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
91. Bananas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
92. Eggs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
93. Red meat (like beef)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
94. Broccoli	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
95. Nuts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
96. Fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
97. Baked potatoes with skin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
98. Chicken	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
99. Baked beans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do you think these foods are high or low in saturated fat?

	High	Low	Not sure
100. Mackerel (fish)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
101. Whole milk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
102. Olive oil	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
103. Red meat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
104. Sunflower margarine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
105. Chocolate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do you think experts call these a healthy alternative to red meat?

	Yes	No	Not sure
106. Liver	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
107. Sliced lean turkey breast	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
108. Baked beans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
109. Nuts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
110. Mozzarella cheese	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
111. Quiche	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do you agree or disagree with the following statements?

	Agree	Disagree	Not sure
112. A glass of unsweetened fruit juice counts as a serving of fruit.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
113. Brown Sugar is a healthy alternative to white sugar.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
114. There is more protein in a glass of whole milk than in a glass of skim milk.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
115. Margarine contains less fat than butter.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
116. There is more calcium in a glass of whole milk than a glass of skim milk.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
117. Some foods contain a lot of fat, but no cholesterol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

118. Saturated fats are mainly found in:

- ☐ Vegetable oils
- ☐ Dairy products
- ☐ Both a and b
- ☐ Not sure

119. Which of these breads contain the most vitamins and minerals?

- ☐ White
- ☐ Wheat
- ☐ Whole wheat
- ☐ Not sure



120. Which do you think is higher in calories: butter or regular margarine?

- ☐ Butter
- ☐ Margarine
- ☐ Both the same
- ☐ Not sure

121. A type of oil that contains mostly monounsaturated fat is:

- ☐ Coconut oil
- ☐ Sunflower oil
- ☐ Olive oil
- ☐ Palm oil
- ☐ Not sure

122. Which of the following has the most calories for the same weight?

- ☐ Sugar
- ☐ Starch/carbohydrate
- ☐ Fiber
- ☐ Fat
- ☐ Not sure

123. Fats that are solid at room temperature contain more:

- ☐ Monounsaturated fats
- ☐ Polyunsaturated fats
- ☐ Saturated fats
- ☐ Not sure

124. Polyunsaturated fats are mainly found in:

- ☐ Vegetable oils
- ☐ Dairy products
- ☐ Both a and b
- ☐ Not sure

Are you aware of any major health problems or diseases that are related to:

	Yes	No	Not Sure
125. Low intake of fruits and vegetables?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
126. Low intake of fiber?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
127. How much sugar a person eats?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
128. How much salt a person eats?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
129. Amount of fat a person eats?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do you think these help to reduce the chances of getting certain kinds of cancer?

	Yes	No	Not sure
130. Eating more fiber	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
131. Eating less sugar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
132. Eating less fruit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
133. Eating less salt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
134. Eating more fruits and vegetables	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
135. Eating less preservatives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do you think these help prevent heart disease?

	Yes	No	Not sure
136. Eating more fiber	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
137. Eating less saturated fat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
138. Eating less salt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
139. Eating more fruits and vegetables	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
140. Eating less preservatives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

141. Which *one* of these is most likely to raise people's blood cholesterol level?

- ☐ Antioxidants
- ☐ Polyunsaturated fats
- ☐ Saturated fats
- ☐ Cholesterol in the diet
- ☐ Not sure

142. Have you heard of antioxidant vitamins?

- ☐ Yes
- ☐ No

Do you think these are antioxidant vitamins?

	Yes	No	Not sure
143. Vitamin A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
144. B-complex vitamins	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
145. Vitamin C	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
146. Vitamin D	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
147. Vitamin E	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
148. Vitamin K	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Food Preparation

Use the space provided below each question to write in your answers to the following questions. Each blank line represents one ingredient needed to make the food item listed; please fill in as many ingredients as you can for each food item. You may leave lines blank. If you do not know any of the ingredients needed to make the food, check the "not sure" box.

**Example:**

*What ingredients are used to make cheese sauce?*

cheese      milk      flour      butter or margarine      seasoning

149. What ingredients are used to make coleslaw?

\_\_\_\_\_

☐ Not sure

150. What ingredients are used to make chicken noodle soup?

\_\_\_\_\_

\_\_\_\_\_

☐ Not sure

151. What ingredients are used to make bread?

\_\_\_\_\_

\_\_\_\_\_

☐ Not sure

152. What ingredients are used to make an apple crisp?

\_\_\_\_\_

\_\_\_\_\_

☐ Not sure

*Imagine you have only a limited amount of time to make a meal for yourself. Check **one** box for each of the following foods to show how long you think each would take to cook...*

	15 minutes or less	More than 15 minutes
153. Vegetable Stir-Fry	<input type="checkbox"/>	<input type="checkbox"/>
154. Steamed Broccoli	<input type="checkbox"/>	<input type="checkbox"/>
155. Pasta Shells (if water is already boiling)	<input type="checkbox"/>	<input type="checkbox"/>
156. White Rice (not instant rice)	<input type="checkbox"/>	<input type="checkbox"/>
157. Baked Potatoes in the oven	<input type="checkbox"/>	<input type="checkbox"/>









	Never or less than 1 per month	1-3 times per month	1 per week	2-4 times per week	5-6 times per week	1 time per day	2-3 times per day	4-5 times per day	6 or more times per day
204. Kale, mustard, collard, or chard greens	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
205. Iceberg or head lettuce	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
206. Romaine or leaf lettuce	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
207. Celery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
208. Green, red, or yellow sweet peppers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
209. Onions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**STOP****This is the end of the survey.***Thank you very much for completing this survey.*

*Please write a valid email address on the bottom portion of this page. Return the completed survey in the box marked "survey" and the slip of paper with your email address in the box marked "prize drawing" in order to be entered into the drawing for the grand prize of \$50 cash or one of five other prizes valued at \$20 each.*

*Cut on this line*

Email Address: \_\_\_\_\_

**You will be notified by email if you are selected as a prize winner in the drawing. You will have two weeks from notification to pick up your prize.**

## Appendix B. Pilot Study Survey

## PILOT TEST

## Social Cognitive Predictors of College Students' Fruit and Vegetable Intake

*Please answer the following questions honestly and to the best of your ability.*

1. Were there any questions that were confusing or unclear?  
If so, please write the number of confusing or unclear questions in the space below.
2. Do you have any suggestions on how to make these questions less confusing or more clear?
3. Was the format of the survey easy to follow?  
Do you have any suggestions for improving the format of the survey?
4. Were the instructions for taking the survey clear?  
Do you have any suggestions for improving the instructions for taking the survey?
5. Do you have any other suggestions about how to improve the survey?

## Appendix C. IRB Approval

# Utah State UNIVERSITY

INSTITUTIONAL REVIEW BOARD OFFICE  
9530 Old Main Hill, Suite 214a  
Logan, UT 84322-9530  
Telephone: (435) 797-1821  
FAX: (435) 797-3769

USU Assurance: FWA#00003308  
Protocol # 2267

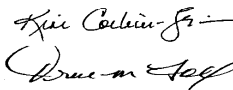
2/27/2009

SPO #:  
AES #: UTA00

## MEMORANDUM

TO: Matthew Flint  
Denice Ahlstrom

FROM: Kim Corbin-Lewis, IRB Chair  
True M. Fox, IRB Administrator



SUBJECT: Social Cognitive Factors Related to College Students' Fruit and Vegetable Intake

Your proposal has been reviewed by the Institutional Review Board and is approved under exemption #2.

- ☒ There is no more than minimal risk to the subjects.  
☐ There is greater than minimal risk to the subjects.

This approval applies only to the proposal currently on file. **Any change in the methods/objectives of the research affecting human subjects must be approved by the IRB prior to implementation.** Injuries or any unanticipated problems involving risk to subjects or to others must be reported immediately to the IRB Office (797-1821).

The research activities listed below are exempt based on the Department of Health and Human Services (DHHS) regulations for the protection of human research subjects, 45 CFR Part 46, as amended to include provisions of the Federal Policy for the Protection of Human Subjects, June 18, 1991.

2. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (a) information obtained is recorded in such a manner that human subjects can be identified, directly or through the identifiers linked to the subjects; and (b) any disclosure of human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.



#### Appendix D. Letter of Information



Department of Health, Physical Education and Recreation  
7000 Old Main Hill  
Logan UT 84322-7000  
Telephone: (435) 797-3823

Date Created: February 27, 2008; Page 1 of 2  
USU IRB Approved: 02/27/2009  
Approval terminates: 02/26/2010  
Protocol Number: 2267  
IRB Password Protected per IRB Administrator

## **Letter of Information**

### **(Social Cognitive Factors Related to College Students' Fruit and Vegetable Intake)**

**Introduction/ Purpose** Senior Lecturer Dr. Matthew Flint in the Department of Health, Physical Education and Recreation, and graduate student Denice Ahlstrom at Utah State University are conducting a research study to find out more about personal and environmental factors that influence college students' fruit and vegetable intake. You have been asked to take part because you are enrolled as a student at Utah State University. There will be approximately 250 participants in this study. It is important that participants complete the entire survey so that researchers have sufficient data for analysis.

**Procedures** If you agree to be in this research study, you will be asked to complete an anonymous survey about the availability of fruits and vegetables in your home, your ability to prepare your food, your confidence in your ability to prepare foods, and your usual fruit and vegetable intake. This survey may take approximately 20 minutes to complete. You will be asked to return the completed survey the next time this class meets. To keep this study anonymous, you will be asked to separate the slip of paper from the survey and deposit in two separate boxes. In order for the researchers to obtain good data it is important that you complete the survey. Participants who complete the survey may enter a drawing for one of six prizes by writing a valid email address on the slip of paper attached to the front of the survey. The prizes include one grand prize of \$50 cash, and five additional prizes valued at \$20 each, including gift cards to local restaurants and stores.

**Risks and Benefits** There is minimal risk in participating in this study. However, you may feel minimal psychological discomfort from revealing information about eating behaviors, home availability of fruits and vegetables, nutrition knowledge, food preparation abilities and self-efficacy.

**Benefits** There may not be any direct benefits to you from these procedures. The investigator, however, may learn more about factors that influence college students' fruit and vegetable intake. The information gained from this study may have direct or indirect benefit to all study participants in the future, as the information may be used in programs aimed at increasing college students' health and wellbeing.

**Explanation & offer to answer questions** Denice Ahlstrom has explained this research study to you and answered your questions. If you have other questions, concerns, complaints, or research-related problems, you may reach Dr Matthew Flint at (435) 797- 3823.

**Payment/Compensation** To thank you for your time in participating in this study and completing the survey, you may choose to be entered into a drawing for one of six prizes. The prizes include one grand prize of \$50 cash, and five additional prizes valued at \$20 each, including gift cards to local restaurants and stores. Winners will be selected by a random drawing and will be notified of winning status via an email sent to the email address provided. Winners will be selected by a random drawing and will be notified of winning status via an email sent to the email address provided. Prizes will be available for pick-up at the HPER main office for 2 weeks following email notification. Prizes not claimed within 2 weeks of notification will be considered forfeited.



Department of Health, Physical Education and Recreation  
7000 Old Main Hill  
Logan UT 84322-7000  
Telephone: (435) 797-3823

Date Created: February 27, 2008; Page 2 of 2  
USU IRB Approved: 02/27/2009  
Approval terminates: 02/26/2010  
Protocol Number: 2267  
IRB Password Protected per IRB Administrator

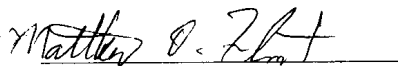
## Letter of Information

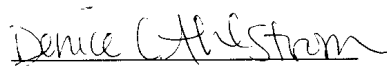
### (Social Cognitive Factors Related to College Students' Fruit and Vegetable Intake)

**Voluntary nature of participation and right to withdraw without consequence** Participation in research is entirely voluntary. You may refuse to participate or withdraw at any time without consequence or loss of benefits. Surveys that are missing critical data will be withdrawn from data analysis.

**Confidentiality** Research records will be kept confidential, consistent with federal and state regulations. Only the investigator and Denice Ahlstrom will have access to the data which will be kept in a locked file cabinet at the student researcher's home for 1 year, and then the surveys will be destroyed. The email address you provide for the drawing, will be kept in a separate locked drawer for one month, and will then be destroyed.

**IRB Approval Statement** The Institutional Review Board (IRB) for the protection of human participants at USU has reviewed and approved this research study. If you have any pertinent questions or concerns about your rights or think the research may have harmed you, you may contact the IRB Administrator at (435) 797-0567 or email [irb@usu.edu](mailto:irb@usu.edu). If you have a concern or complaint about the research and you would like to contact someone other than the research team, you may contact the IRB Administrator to obtain information or to offer input.

  
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